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RUN REPORTS: CO_2 ACCEPTOR PROCESS GASIFICATION PILOT PLANT

Final Report, Volume 8, Book 5 of 6, Runs 37–42
May 1976–February 1977

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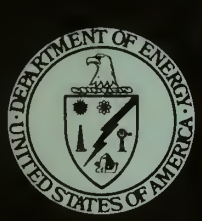

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RUN REPORTS

CO_2 ACCEPTOR PROCESS GASIFICATION PILOT PLANT

FINAL REPORT, VOLUME 8
BOOK 5 OF 6, RUNS 37 - 42
PERIOD: MAY 1976 - FEBRUARY 1977

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AMERICAN GAS ASSOCIATION
UNDER CONTRACT EX-76-C-01-1734

FOREWORD

The reports contained in this document were prepared jointly by Conoco Coal Development Company and Stearns-Roger, Incorporated, as partial fulfillment of the Department of Energy contract (EX-76-C-01-1734) for the development of CO_2 Acceptor Gasification Process. Each report normally covers the operation of the CO_2 Acceptor Process Pilot Plant for a single run. Some runs, however, have several parts (A, B, C, etc.) and occasionally two or more runs have been grouped together in a single report.

The reports are informal data reports which were written shortly after the completion of the respective runs. The reports serve the purpose of recording the objectives, accomplishments, and problems encountered during the pilot plant operations. Operating data are also often presented. However, these data are, for the most part, presented as a matter of record since the inclusion of heat and material balances and the analysis of the data was not part of the scope of the run reports.

Prior to Run 16, no periods of truly steady-state integrated plant operation were obtained for which heat and material balances can be calculated. The development of a reliable, standardized startup procedure, the solving of process and especially mechanical equipment problems, were the primary concerns during these early runs.

Much needed process data at steady-state conditions were gathered during the later runs. Detailed heat and material balances for selected runs are presented in Volume 12 of the Final Report. Some discrepancies will be found between the data presented in the run reports and the heat and material balance results. For example, the acceptor circulation and gasifier vent rate presented in many of the run reports do not agree with the heat and material balance values.

The run report acceptor circulation rates are based upon the acceptor lift line pressure drop and are considered to be only an approximation of the actual acceptor circulation rate. The pressure drop derived circulation rate served as a guide to the plant operators and provided trend information. Because of the severe temperature and pressure conditions in the process, the acceptor circulation and also the fuel char rates cannot be directly measured. These rates can only be accurately determined via detailed heat and material balance calculations. A mathematical model of the process, which is embodied in the form of a computer program was therefore developed. The model values for the acceptor circulation and the fuel char rates are presented in the detailed heat and material balances. These rates are considered to be correct.

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The measured gasifier vent rates (product gas rates) contained in the run reports are generally lower, and often much lower, than the mathematical model values. There are several reasons for this. First, process flow measuring instrumentation was often fouled by the small amounts of char fines and liquid water contained in the vent gases. Secondly, undetected process leaks from valve packings and from vessel and piping flanges represent sizable losses in the available vent gas quantity to be measured. The actual vent gas from the gasifier is better represented by the mathematical model value than by the measured value.

The above examples point out that consideration must be given and judgements made concerning the use of certain process data. The philosophy with respect to data analysis, has been to use the mathematical model to match as much as possible the measured process data. Differences between the model results and the measured data are resolved by the reexamination of instrument records and the pilot plant logs or by modifying the model where necessary.

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RUN 37

RUN 37A MAY 21 TO MAY 27, 1976

RUN 37B JUNE 3 TO JUNE 14, 1976

CO_2 ACCEPTOR PROCESS GASIFICATION

PILOT PLANT

RAPID CITY, SOUTH DAKOTA

1 SUMMARY

Run 37, which was conducted in two parts, was the first time that a subbituminous coal was used as a feedstock in an integrated plant operation. The run featured Rosebud coal as a gasifier feedstock.

Run 37A was notable in two respects. Most important, there was no evidence of coke formation due to the feeding of raw subbituminous coal, confirming the idea that pretreatment will not be required. The other notable occurrence was the generation of a large amount of coal fines in the feed to the gasifier. The grinding properties of the Rosebud coal were such that the amount of fines in the coal leaving the preheater averaged more than 20 weight percent -100 Tyler mesh. Normally, for a lignite feedstock the -100 mesh material averages less than 10 weight percent.

After about 39 hours of operation with Rosebud coal as a gasifier feedstock, the run suddenly ended after a boot upset caused the loss of acceptor circulation from the gasifier to the regenerator. When circulation could not be reestablished, the plant was shut down.

In the second run, 37B, the mill was altered to produce a coal feed which contained about 10 weight percent of -100 mesh material. This run lasted over three times as long as the previous run, logging 113 hours of operation with Rosebud coal as the feedstock. The run, which was terminated by a four-hour power failure, lasted long enough to reveal an accumulation of intermediate fines in the gasifier char bed. These fines, which are thought to have contributed to considerable instability of the char-acceptor interface during the last 27 hours of the run, were shown to have originated in the coal feed. Some of the fines were caused by contamination of the Rosebud coal pile during storage at the local power plant. Slag from the power plant's cyclone burners was mixed with the stored coal. The rest of the junk came from the Rosebud coal ash which was found to contain large quantities of clay-like particles and a high proportion of +80 Tyler mesh material.

2 TEST DATA

Run 37A and 37B data are presented graphically and/or tabularly at the end of this run report. These figures and tables include:

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3 SIGNIFICANT EVENTS AND OBSERVATIONS

3.1 TABULAR HISTORY OF RUNS 37A AND 37B

3.1.1 Objectives for Both Runs

(1) Demonstrate plant operability using a new coal feedstock (Rosebud subbituminous).

(2) Achieve a long duration, steady-state period during which heat and material balance data could be collected.

(3) Operate the methanation unit to produce pipeline quality gas.

(4) Operate the Elliott test turbine.

(5) Follow the balance period with a voluntary and planned shutdown of the plant.

3.1.2 Accomplishments

Run 37A

(1) Operated the pilot plant in an integrated manner and replaced a sufficient amount of the initial dead-burned dolomite inventory with fresh limestone to allow removal of all air from the gasifier.

(2) Operated the plant for 15 hours with all recycle gas removed from the gasifier boot flow. During this period, the only feeds to the gasifier were Rosebud subbituminous coal, Minnekahta limestone, steam and a small amount of CO_2 (1,000 SCFH).

Run 37B

(1) Operated the pilot plant in an integrated manner and replaced a sufficient amount of the initial dead-burned dolomite inventory with fresh limestone to allow removal of all air from the gasifier.

(2) Operated the plant for over 32 hours with no recycle to the gasifier boot.

(3) Survived a major boot upset during which the char-acceptor interface was blown away to prevent it from rising into the transition zone. Within two hours of the upset, the plant was back on line.

(4) Operated the methanation unit for 22 hours before the boot upset. After the upset, the unit was not put back on line.

3.1.3 Termination Causes

Run 37A

The run ended as a result of a gasifier boot upset during which the acceptor collected in the transition section and defluidized. This caused the loss of acceptor transfer from the gasifier. It was hypothesized that the boot upset was due to the entrapment of fine coal particles from the Rosebud feedstock in the transition section of the gasifier. The showering acceptor trapped the fine char particles which then formed a solids bridge at the inlet to the boot.

Run 37B

A violent thunderstorm with heavy rains and high winds caused an electric power failure which lasted for four hours. Power failures lasting longer than two seconds cause the gasifier and regenerator beds to defluidize. It is not usually possible to lift them back up after power is regained.

3.1.4 Mechanical Problems

Run 37A

Only minor mechanical problems, all of which were located in the grinding area, were encountered during this run. The problems included a conveyor belt control circuit failure, a crack in the baghouse blower discharge piping, and problems with the variable speed roller mill feeder. The raw Rosebud coal was very wet, causing a large number of plugged lines in the grinding area.

Run 37B

(1) High pressure differential on the baghouse due to buildup on the inside of the bags. The problem was solved by changing bags.

(2) The spool piece above LCV-2003 had loose refractory. A piece of this refractory broke free and settled on top of the LCV-2003 butterfly, restricting the acceptor circulation. The restriction was discovered during the circulation tests. The gasifier was then depressured, cooled, emptied, and the refractory repaired.

(3) The main air compressor, J-202, was shut down for repairs for a total of six hours early in the second startup attempt. The rings in the third stage discharge were replaced, as were the second and third stage suction valves.

(4) The line from the regenerator ash dump hopper, F-207C, to the slurry tank, F-223, plugged every time the hopper was dumped. This was caused by water from the slurry tank being splashed into the line by the mixer. This problem became quite a nuisance, as it was necessary to dump the hopper at least twice a shift. Also, unplugging the line enabled noxious gases to escape into the structure from the slurry tank. This problem will be eliminated in future runs by routing the ash from F-207C to a tote bin outside the main entrance.

(5) During the shutdown a leak was discovered in a gasifier side flow heater. Inspection after shutdown revealed cracks in the convection section of this heater, B-201-IIIB. The coil will be bypassed until a new one can be fabricated and installed.

3.1.5 Process Problems

Run 37A

The gasifier char bed samples (Table 37-11) revealed a much higher than normal level of -100 mesh material in the bed. The high amount of fines in the bed was caused by the presence of an excessive amount of -100 Tyler mesh material in the Rosebud coal fed to the gasifier. The feedstock fines averaged over twenty weight percent -100 mesh material, while normally for a lignite feedstock the -100 mesh material averages less than ten percent.

Run 37B

During this run the amount of -100 mesh material in the Rosebud feed to the gasifier was kept well below ten percent. This eliminated the buildup of -100 mesh material in the char bed and enabled the plant to run far longer than in the previous run. This longer run revealed two new process problems:

(1) The density in both the regenerator bed and the bottom of the gasifier boot dropped much lower than usual. The density in the bottom of the boot became as low as 62 LB/FT^3 before the boot upset. After the upset, the density in the regenerator and the bottom of the boot was about 58 LB/FT^3, far lower than the normal range of 65 to 68 LB/FT^3 for the lignite runs.

(2) Junk* continually built up in the gasifier char bed causing a somewhat higher than normal char bed density. The junk consisted of agglomerated acceptor fines and clay-like particles from the coal ash. The combination of high junk and low acceptor density made the gasifier char-acceptor interface very difficult to control and caused the major boot upset on June 13, as well as many minor upsets from June 12 to the end of the run on June 14.

3.2 CHRONOLOGY OF OPERATIONS

Run 37A

Date	Time	Hours Run	Description
5/21	1320		Pressured the system with air.
"	1615		System up to pressure, started the static pressure test.
"	1700		Finished the static pressure test.
"	1930		Started all recycle compressors.
"	2200		Started the heater differential pressure tests.
"	2350		Finished the heater differential pressure tests. Lit all heaters.
5/22	0330		Started the first refractory cure holding period.
"	1130		Finished the refractory cure holding period, continuing with system heatup.
"	1900		Started the second refractory cure holding period.
"	2100		Started grinding Rosebud subbituminous coal for the preheater.
"	2300		Finished the second refractory cure holding period, continued with system heatup.
5/23	0230		Zinc oxide units placed on line.
"	0600		Began feeding dead-burned dolomite to the gasifier via F-204A, lignite feed lockhopper.
"	0850		Transferred a batch of dead-burned dolomite from the gasifier to the regenerator.
"	0917		Started feeding dead-burned dolomite to the regenerator via F-206, fresh limestone feed lockhopper.
"	1700		Stopped grinding Rosebud coal and started grinding char.
"	2000		Established solids circulation.
"	2045		Resumed grinding Rosebud coal for the preheater. NOTE: The coal was very wet and some difficulty in grinding was experienced.

* Inert material in the size range of 20 x 65 Tyler mesh.

Date	Time	Hours Run	Description
5/23	2115		Started the solids circulation test. Stopped feeding dead-burned dolomite makeup to the regenerator.
"	2130		Circulation tests finished, resumed dead-burned dolomite makeup.
"	2247		Started feeding char to the gasifier via F-204A.
5/24	0140		Introduced air to the gasifier side flow ring.
"	0345		Initiated steam flow to the gasifier boot.
"	0410		Preheater full of Rosebud coal, stopped grinding.
"	0545		Started feeding auxiliary char to the regenerator.
"	0745		Char transfer established.
"	0850	0	Regenerator at 1800°F.
"	1643		Began feeding Rosebud subbituminous coal to the gasifier via F-204A.
"	2110		Initiated CO_2 to the gasifier boot.
"	2115		Started grinding Rosebud coal for the preheater.
"	2120		Began feeding fresh limestone to the regenerator via F-206.
5/25	1158		All air removed from the gasifier side flow ring.
"	1540	30.8	All recycle gas out of the gasifier boot.
"	2400		Had difficulty grinding coal due to plugging in the feeder to the roller mill and a high baghouse differential pressure.
5/26	0715	46.4	Unable to shower acceptor from the gasifier bed into the boot. Stopped all solids makeup and solids transfer. Tried to mix up gasifier bed by increasing boot and side flows.
"	1050		Decision made to shut down plant operation.
"	1100		Shut down grinding area operations.
5/27	0400		Unit depressured.
Run 37B			
6/3	1625		Started grinding Rosebud subbituminous coal for the preheater.
"	1705		Pressured up the system with air.
"	1847		System up to pressure, started the static pressure test.
"	1932		Finished the static pressure test.
"	1951		Started all recycle compressors and began circulating gas.
"	2025		Lit all heaters.

Date	Time	Hours Run	Description
6/3	2345		System at 250°F, started the first refractory cure holding period.
"	2350		Started the heater differential pressure tests.
"	2400		NOTE: 100 area grinding was slow due to a high baghouse differential pressure.
6/4	0245		Finished the first refractory cure holding period and continued with the system heatup.
"	1400		System at 700°F, started the second refractory cure holding period.
"	1600		Finished the second refractory cure period, continued with system heatup.
"	1830		Zinc oxide unit placed on line.
"	2145		Started feeding dead-burned dolomite to the gasifier via F-204A, fresh lignite feed lock-hopper.
6/5	0100		Transferred a batch of dead-burned dolomite to the regenerator from the gasifier.
"	0300		Started feeding dead-burned dolomite to the regenerator via F-206, fresh acceptor makeup lockhopper.
"	0950		Started solids circulation. NOTE: Unable to establish a high rate of circulation. Restriction apparently near LCV-2003.
"	1430		Unable to clear plug near LCV-2003, shut unit down.
"	1500		Analysis of material in preheater showed high fines. Decided to drain the preheater.
"	1555		Zinc oxide unit taken off line.
6/6	0530		Unit depressured. NOTE: Found the spool piece above LCV-2003 with loose refractory. A piece of refractory resting on LCV-2003 butterfly valve restricted the circulation rate. Spool piece was repaired and replaced.
"	0700		Maintenance replaced the bags in the 100 area.
"	1430		Pressured up the unit with air.
"	1500		100 area repaired and began grinding Rosebud coal again.
"	1540		System up to pressure, found a leak on a flange. Depressuring the unit.
"	1635		Leak repaired, pressuring up the unit.
"	1700		System up to pressure, started the static pressure test.
"	1720		Static pressure test finished.
"	1730		Started the recycle compressors and began circulating gas.
"	1835		Lit all heaters.

Date	Time	Hours Run	Description
6/6	2000		System at 250°F, started first refractory cure holding period.
"	2030		Began the heater differential pressure tests.
"	2130		Finished the heater differential pressure tests.
"	2200		Finished the refractory cure holding period.
"	2400		NOTE: Ran grinding tests in the 100 area to find best grinding rate.
6/7	0815		Maintenance tied back the rollers in the roller mill because too many fines were produced when grinding Rosebud coal.
"	1110		Feeding dead-burned dolomite to the gasifier via F-204A.
"	1120		Stopped feeding dead-burned dolomite to the gasifier until results from 100 area grinding tests are finished.
"	1410		Zinc oxide unit placed on line.
"	1855		Began grinding tests in the 100 area.
"	2350		Grinding tests showing less fines, resumed filling the gasifier boot with dead-burned dolomite. Fed Rosebud coal to the preheater.
6/8	0345		Transferred a batch of dead-burned dolomite to the regenerator.
"	0420		Started filling the regenerator with dead-burned dolomite via F-206.
"	0440		Shut down 100 area for maintenance work.
"	1216		Established solids circulation, began solids circulation tests.
"	1325		Finished the solids circulation tests. NOTE: Removed air flow to the system in order to repair J-202, main air compressor.
"	1415		Maintenance finished in 100 area, began grinding Rosebud coal for the preheater.
"	1840		J-202 repaired, put air back to the system.
"	1915		Introduced steam to the gasifier side flow.
"	2018		Started feeding char to the gasifier via F-204A.
6/9	0440		Air removed from the system again in order to repair J-202.
"	0600		J-202 repaired, put air back into the system.
"	0800		Established char transfer.
"	0815		Introduced steam to the gasifier boot flow.
"	1020	0	Regenerator at 1800°F.
"	1145		Started feeding auxiliary char to the regenerator
"	1400		Ran heater differential pressure test on B-207, steam superheater.
"	2400		100 area had some difficulty with the baghouse carriage.

Date	Time	Hours Run	Description
6/10	0320		Began feeding Rosebud coal to the gasifier.
"	0600		100 area shut down for maintenance.
"	1501		Filled F-206 with fresh 6 X 9 limestone.
"	1600	29.7	Initiated CO_2 to the gasifier boot flow.
"	1700		Began grinding Rosebud coal in the 100 area.
6/11	0740		Experienced two power dips, recovered quick enough that the plant was not upset.
"	1620	54	Started synthesis gas flow to the front end of the methanation unit.
"	1800		Experienced three power dips in a row without upsetting the plant.
"	2400		NOTE: Started to experience a high density in the gasifier. The preheater differential pressure taps started to plug giving a false bed level reading.
6/12	0015		All air removed from the gasifier side flow.
"	0810		Gasifier recycle gas flow removed from the boot flow.
"	1045	72.4	Attempted to place F-215/216, char removal pots, on line. Lost char transfer, then isolated the pots from the system.
"	1545		Gasifier boot acted as if unable to transfer out. Stroked LCV-2003 and the boot returned to normal.
"	1630		Gasifier boot looked bad again. Increased boot flow and the boot lined out.
6/13	0842		Lost coal feed for approximately five minutes.
"	1650		Experienced an upset in the gasifier boot, put all flow possible in boot. Recycle gas was put in at this time. All feed to the system and circulation was stopped. Removed synthesis gas from methanation unit.
"	1710		System lined out, circulation going again and coal feed started.
"	1900	104.7	Started sending synthesis gas to the methanation unit again.
"	2400		Plant slowly recovered from upset. The gasifier boot very sensitive to minor changes and not looking normal.
6/14	0000-1800		Gasifier boot very sensitive, moving side flow had very little effect at this time.
"	1806		Small power dip, recovered without upsetting system.
"	2005	127.7	Total power failure, no recovery possible. All compressors shut down.
"	2400		Discovered a leak in B-201-IIB, gasifier side flow heaters while shutting down.

4 RESULTS AND DISCUSSION

4.1 BACKGROUND

Prior to these two runs, Rosebud coal had never been used as a gasifier feedstock and integrated plant operation had never been attempted using a subbituminous coal. The only previous plant experience with subbituminous coals was in Run 31 in which only the gasifier was operated, and all heat was supplied by air injection to the gasifier side flow ring. Two subbituminous coals, Westmoreland and Wyodak, were studied in that run. Those tests indicated that preoxidation of subbituminous coals was unnecessary because no evidence of coking or tar and oil formation was shown.

4.2 ACCOMPLISHMENTS

4.2.1 Major Operational Achievements

The pilot plant operations for Run 37A and 37B are summarized below:

SUMMARY OF PLANT OPERATIONS
HOURS OF OPERATION

Run	Acceptor Circulation	Process Conditions	Subbituminous Feed	Fresh Acceptor Makeup	Without Air to Gasifier	Without Recycle to Boot
37A	60	46	39	34	20	16
37B	155	130	113	102	62	33

4.2.2 Plant Data

The pertinent data for both runs are presented in Tables 37-1 through 37-22. Operating conditions are shown in Tables 37-1 through 37-4. Feedstock composite analyses are presented in Tables 37-5 and 37-6. Effluent and circulated process stream solids analyses are shown in Tables 37-7 through 37-20. Pressure balance data and calculated pressure balances are given in Tables 37-21 and 37-22. Locations and elevations for the pressure points are shown in Figure 37-1. The raw pressure balance data was corrected as described in the Run 17 report and forced to converge as explained in the Run 28 report. Table 37-23 contains the analyses of the glassy impurities found in the Rosebud coal feed for Run 37B and the glue-like particles found in the circulating acceptor in that run.

4.2.3 Activity

The acceptor activity is defined as the moles of active calcium oxide per mole of calcium in the stone. The activity, which serves as a measure of the acceptor's ability to react with CO_2, is plotted as a function of time in Figure 37-2. From the plot it is apparent that Run 37A did not continue long enough to enable the complete change out of the dead-burned dolomite acceptor. However, the activity behavior for the run generally followed the trend for Run 37B.

During Run 37B over 90 percent of the initial dead-burned dolomite inventory was changed out. Figure 37-2 shows that for the last 60 hours of the run the activity ranged from .10 to .13. Previous runs with Velva lignite also had a steady-state activity in this range, proving that the subbituminous coal ash has no ill effects on the acceptor activity.

4.3 PROBLEMS

4.3.1 Grinding

Run 37A was the first time that Rosebud subbituminous coal was ground in the pilot plant roller mill. Many plugging problems were encountered due to the wetness of the feed. Several mechanical problems were also encountered in the grinding area as mentioned previously. However, the most serious problem was the generation of an unusually large amount of coal fines in the feed to the gasifier. Samples of the coal from the preheater showed that the amount of -100 mesh material averaged over 20 weight percent. Normally, for a lignite feedstock, the -100 mesh material averages less than ten percent.

As shown in Figure 37-1, the samples of the coal entering the preheater from the mill were inconsistent, about half containing 5 percent fines, the rest about 15 percent. It was postulated that the fines in the coal feed were being created by attrition in the preheater. A series of tests were performed using different gas velocities in the preheater. However, no significant improvement in the amount of fines leaving the preheater was obtained, so the problem was obviously with the roller mill. The journals in the mill were tied back to the main shaft, increasing the clearance between the rollers and the grinding ring. This solved the problem. As shown in Figure 37-5, the -100 mesh material leaving the preheater in Run 37B averaged well below ten weight percent.

4.3.2 Heater Deterioration

After Run 37A

(1) Regenerator air heater, B-203. A large section of refractory was found spalled from the west inlet tubes and two small gouges were found on these tubes. The gouges were filled with 310CB weld metal and the refractory was repaired.

(2) Acceptor lift gas heater, B-205. Thickness measurements revealed a small thinned out area on the outlet of the top pass. The area was approximately 0.50 inch in diameter with a thickness of 0.10 inch indicating as a loss of 0.04 inch. An attempt to overlay the area was made but was unsuccessful. A two-foot section of the pass was then replaced. The tubes of this heater are under constant sulfur attack and are closely monitored.

After Run 37B

(1) Gasifier boot heater, B-201A. The refractory in B-201-IIA was found spalled in several places and was repaired. The diffuser pan in the convection section (B-201-IIIA) contained cracks at all support attachment areas and was repaired.

(2) Gasifier side heater, B-201B. The upper core refractory in B-201-IIB required some repair because of cracking and spalling. Close examination of the convection section (B-201-IIIB) in which a leak was detected during shutdown revealed two cracks in the coil. Sections of the coil were removed for analyses, and the coil will be bypassed while a replacement is being fabricated.

Analysis of the samples revealed four longitudinal cracks located in small bulges in one sample. These cracks were probably creep failures caused by localized hot spots. The Type 321 stainless steel used is very weak at temperatures in the rapid gain growth range (1600° to 2000°F) and bulging and cracking could occur in a fairly short time.

Analysis of the other sample revealed two circumferential cracks which were apparently caused by thermal fatigue. These tubes had seen 12,500 hours of service, and the cyclical thermal stresses from the numerous furnace shutdowns and startups associated with pilot plant operations had finally taken their toll.

(3) Acceptor lift gas heater, B-205. Thinned areas .08-inch thick were found at several locations in the top two coils and a portion of the third coil from the top. Three hundred sixty degrees of the top two coils were replaced as were 180 degrees of the third coil. The thinning is due to constant attack by sulfur which slips through the SO_2 scrubbing tower. The upper cone refractory had cracked in several areas and one area had spalled. The refractory was repaired.

4.3.3 Deposits

Run 37A

The only significant deposit found during the shutdown following Run 37A was in the gasifier bottom head on top of the boot distributor. The deposit was mostly soft, loosely packed and made up of active limestone acceptor. The deposit extended five to six inches above the bottom head flange and completely covered the inlet to the gasifier dump hopper, F-213. It formed a cone leading to the acceptor transfer line.

Beneath the limestone, a hard-faced deposit of dead-burned dolomite was found around two-thirds of the boot circumference. This deposit was about two-inches thick and was not present near the acceptor transfer outlet. The line to F-213 was plugged with hard dead-burned dolomite, as was the area between the bubble caps of the boot distributor.

Run 37B

The major deposits were found in the gasifier after Run 37B. One deposit was in the transition section just above the side flow distributor ring. This deposit was hard and appeared to be made up of active limestone acceptor. There was an opening in the deposit, about one-eighth of the cross-sectional area, leading into the boot.

The other deposit was in the bottom head of the gasifier. It was similar to deposit formed in the previous run except that it was made up mostly of dead-burned dolomite. The deposit again formed a natural slope to the inlet of the acceptor transfer line and covered the inlet to F-213. About one-third of the deposit, starting along the wall and boot distributor and leading towards the middle, consisted of loose dead-burned dolomite. The inlet line to F-213 was also filled with loose dead-burned dolomite. The remainder of the deposit was gray or white colored and appeared to be slaked dead-burned dolomite.

Commentary

The deposit found in the transition section of the gasifier after Run 37B was obviously formed during the final upset and shutdown. The high rate of circulation present before the final upset could not have been maintained had there been such a large restriction in the transition area. In addition, the deposit looked very similar to the samples of the circulating acceptor taken shortly before the final upset.

During both runs deposits were found in the boot. It has been known for some time that varying amounts of dead-burned dolomite are trapped in the bottom of the boot and never changed out with fresh limestone acceptor. Sometimes, as in Run 37A, only a small amount is trapped, and it may form a hard deposit. In other runs, such as Run 37B, a large amount of dead-burned dolomite remains. The presence of dead-burned dolomite on top of the boot flow distributor for an entire run can significantly alter the gas distribution pattern through the lower part of the boot. Poor gas distribution due to a large amount of dead-burned dolomite in the bottom of the boot for the entire run might explain why the char-acceptor interface was so unstable during the latter half of Run 37B. The dead-burned dolomite in the boot also provides a surface upon which a deposit of active acceptor can grow. The active acceptor boot deposits have shown a disturbing tendency to break off and block either the inlet to the circulating acceptor transfer line or the control valve in this line, LCV-2003. This almost always terminates a run due to the inability to circulate acceptor.

To eliminate the entrapment of dead-burned dolomite and provide better gas distribution in the lower boot, work has begun on the design of a new gas distributor for the boot. A scale model of the new distributor will be tested in the glass model before being installed in the gasifier.

4.3.4 Light Limestone

As Run 37B continued, the density of the acceptor fluidized beds in the regenerator and the gasifier boot continued to decrease. The recarbonated acceptor density dropped as low as 54 LB/FT^3 and seemed to line out at about 59 LB/FT^3. This is significantly lower than the density of 68 LB/FT^3 obtained for a long period of time in Run 33B with Velva lignite. The light limestone density made it more difficult to maintain the char-acceptor interface and required readjustment of the normal boot gas flow rate.

The decrease in the acceptor bed density was due to a decrease in the limestone particle density. The particle density at the end of this run varied from 105 to 110 LB/FT^3, while in Run 33B it ranged from 125 to 130 LB/FT^3. This decrease in density is due to the difference in the shell laid down on the acceptor particles during interaction with the coal ash. The acceptor in Run 33B had a very thick shell enriched with aluminum, iron and silica. The shells on the particles in Run 37B were very thin and therefore difficult to separate and analyze. More laboratory work will be required to explain the differences in the interaction between the acceptor and lignite or subbituminous coal ash.

4.3.5 Intermediate Fines

Run 37A did not last long enough to yield any meaningful information on the accumulation of intermediate fines in the gasifier char bed. Run 37B, which lasted three times longer, did reveal problems with the accumulation of intermediate fines in the char bed. Figure 37-3 shows the rapid buildup of intermediate fines in the gasifier. During this time the char bed density increased from 36 to 41 LB/FT^3.

Part of the increase in the amount of intermediate fines was undoubtedly due to the decrease in limestone density. The lighter stone would not shower as readily through the char bed. Another explanation for the high level of intermediate fines was provided by the discovery of a large number of agglomerated acceptor particles found in the circulating acceptor samples. The agglomerates consisted of acceptor fines held together by a gray "glue." Many particles of pure "glue" from which the acceptor fines had broken away were also found.

Examination of the coal feedstock revealed the presence of large amounts of glass-like material. The source of this material was found to be slag from the local power plant's cyclone burners. The Rosebud coal used as feedstock had been stored for some time at the power plant. Chemical analyses of the "glass" and "glue" materials shown in Table 37-23 reveal that the two materials have a nearly identical composition.

Another source of intermediate fines was the Rosebud coal ash. The Rosebud coal was found to contain a high proportion of fine materials which would not pass through an 80 Tyler mesh screen. These particles appeared to be derived from clay.

The buildup of intermediate fines and concurrent increase in char bed density made it difficult to maintain the char-acceptor interface which was already troubled by the unusually light limestone.

5 FUTURE PLANS

The next run will use Wyodak subbituminous coal as a feedstock since it contains much less +80 mesh ash material than the Rosebud coal. The Wyodak coal will be delivered by truck directly to the plant and will not be subject to contamination. This change in coal should make it easier to control the amount of intermediate fines in the gasifier. Work will begin on the design and testing of a new gasifier boot flow distributor. Laboratory work will also begin to better explain the cause of the lighter limestone particle density found when using subbituminous coal.

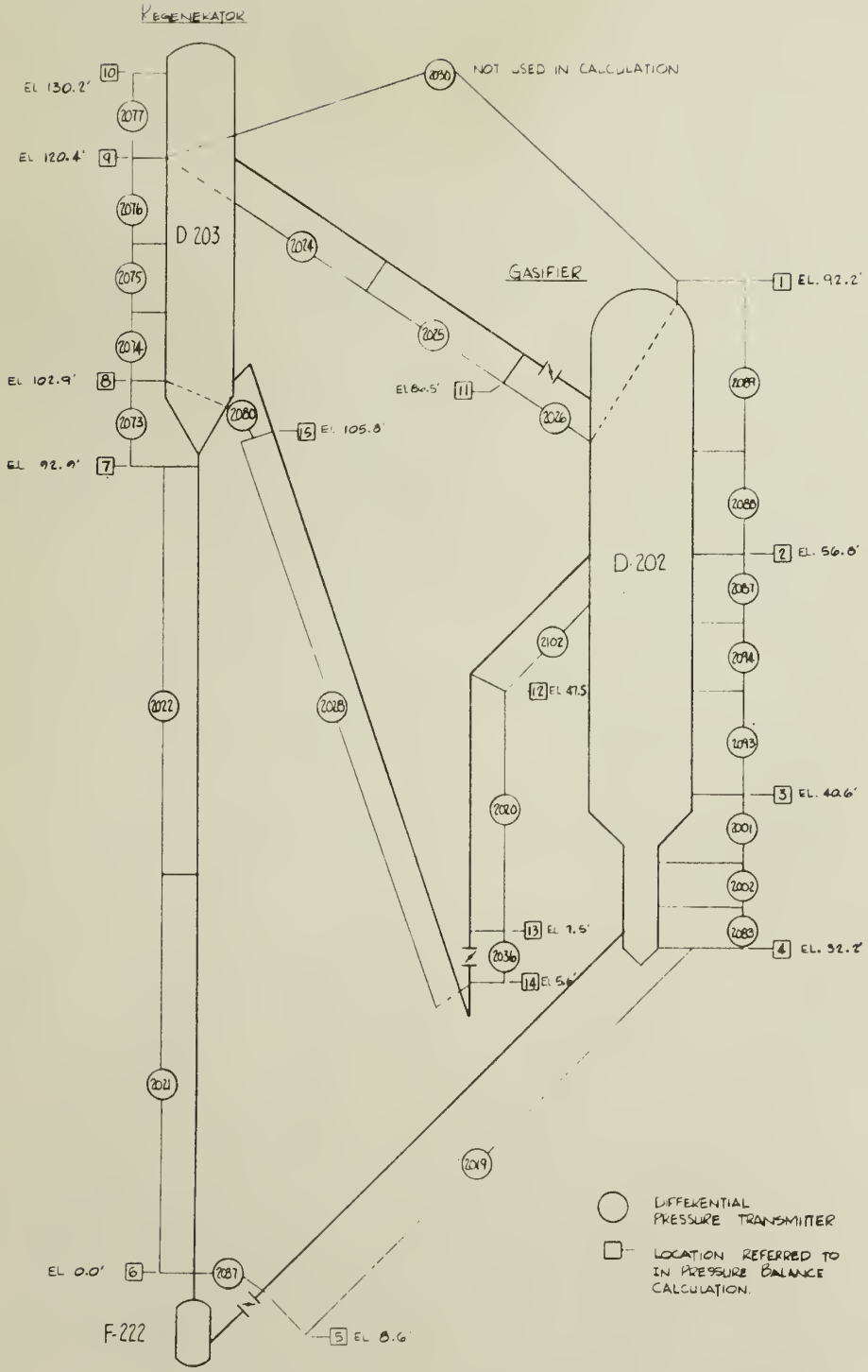

Figure 37-1. DIFFERENTIAL PRESSURE TRANSMITTER LOCATION PRESSURE BALANCE CALCULATION

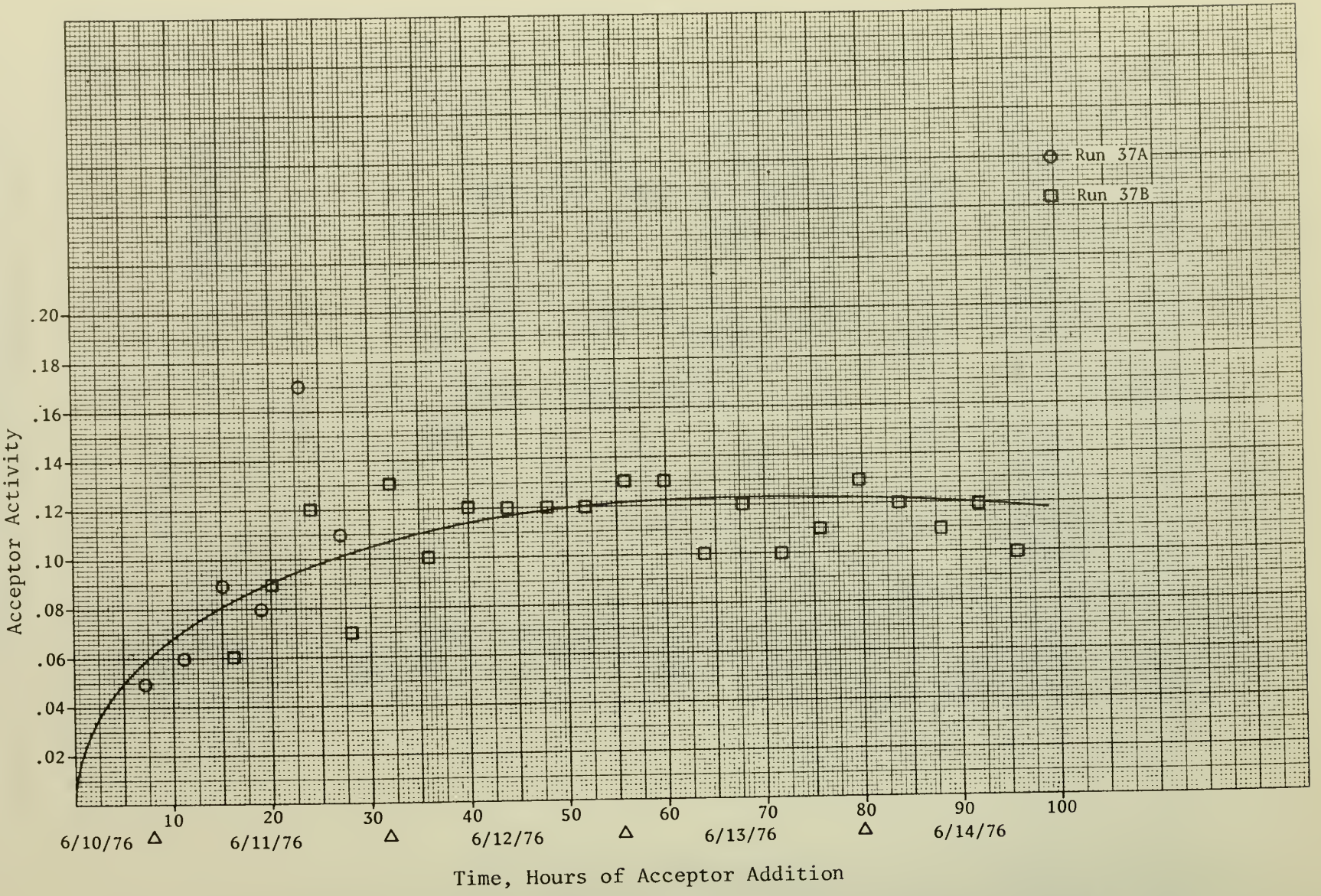

Figure 37-2. ACCEPTOR ACTIVITY FOR RUNS 37A and 37B

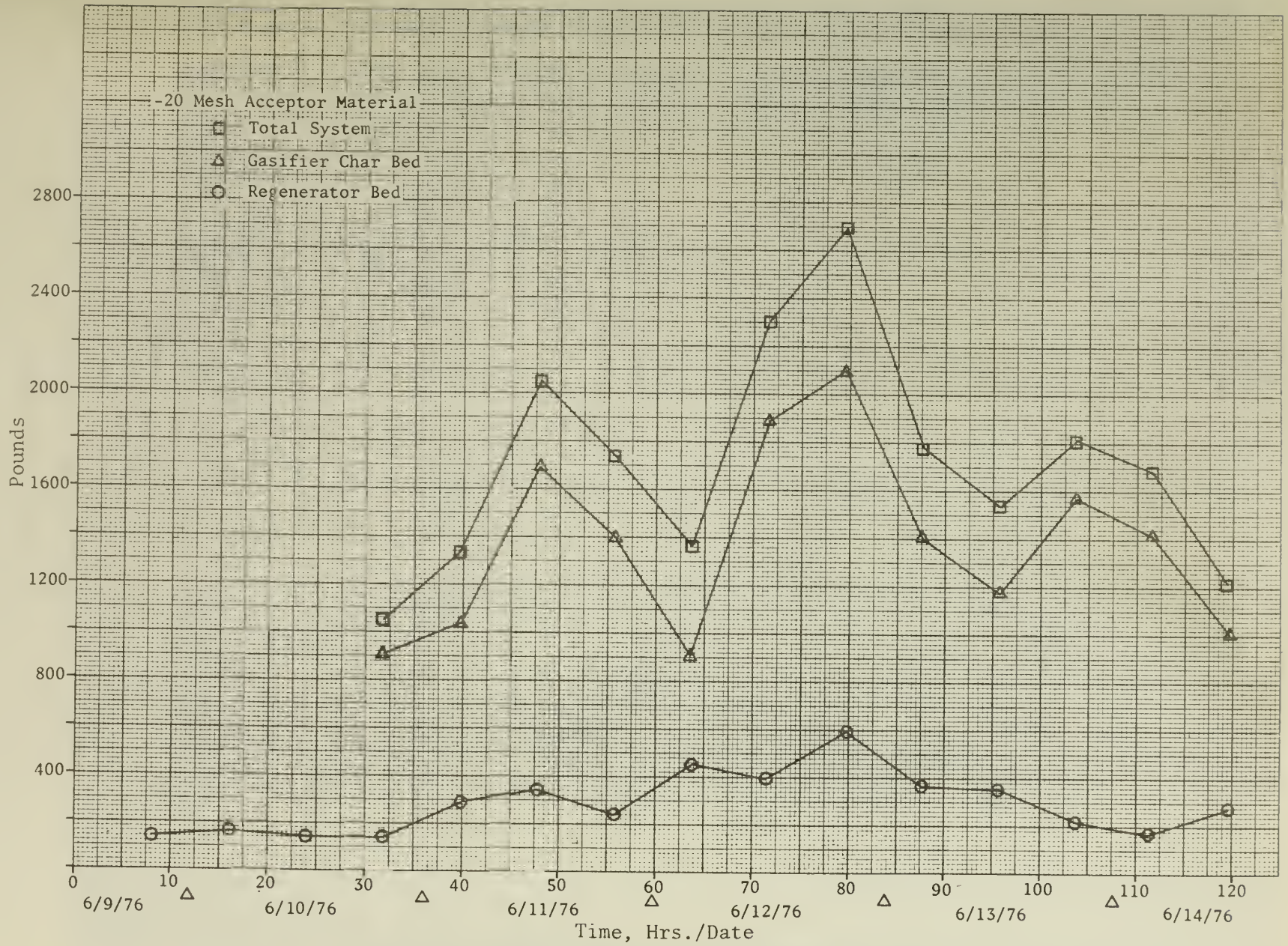

Figure 37-3. INTERMEDIATE FINES INVENTORY FOR RUN 37B

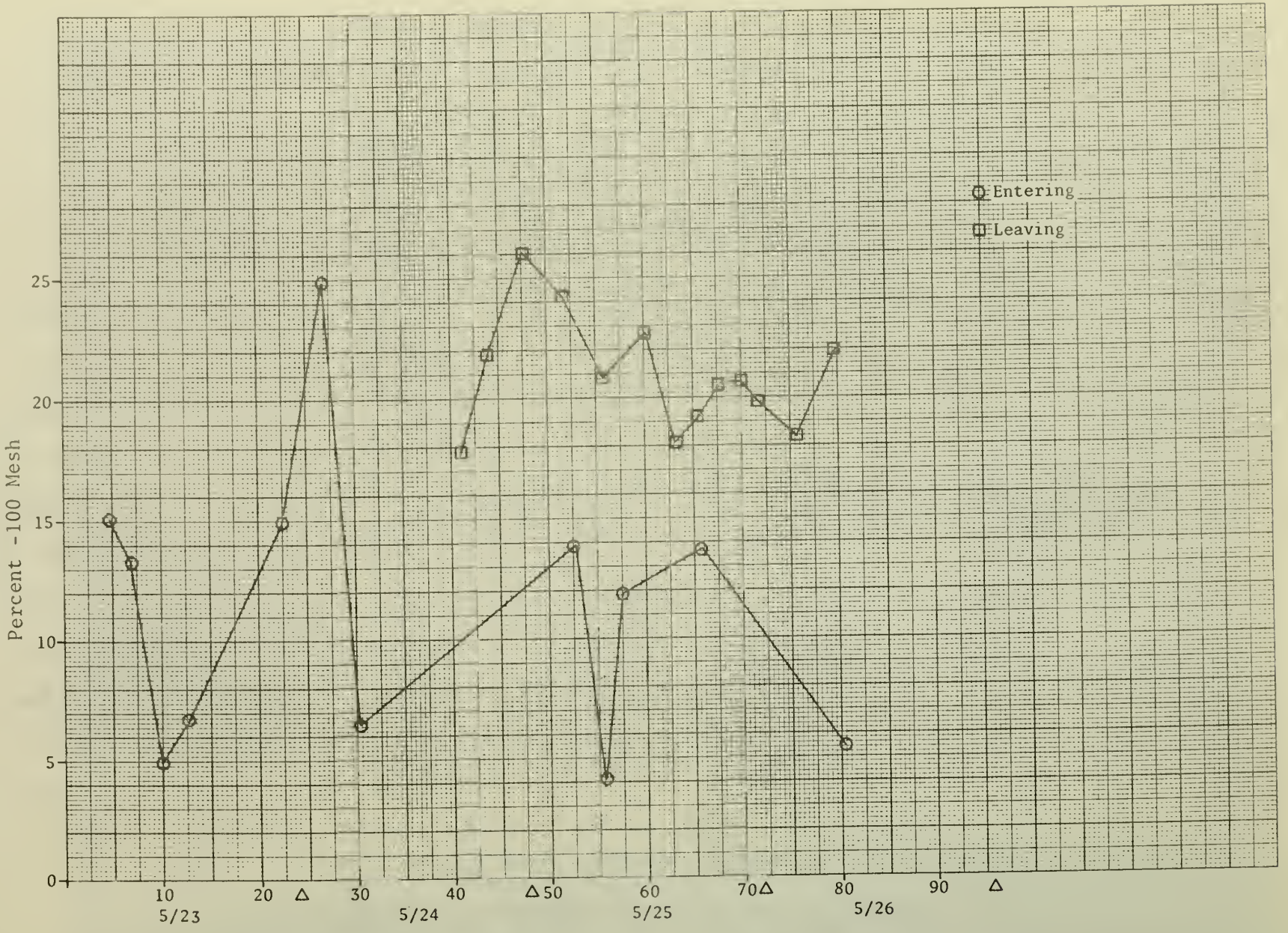

Figure 37-4. -100 MESH MATERIAL ENTERING AND LEAVING THE PREHEATER FOR RUN 37A

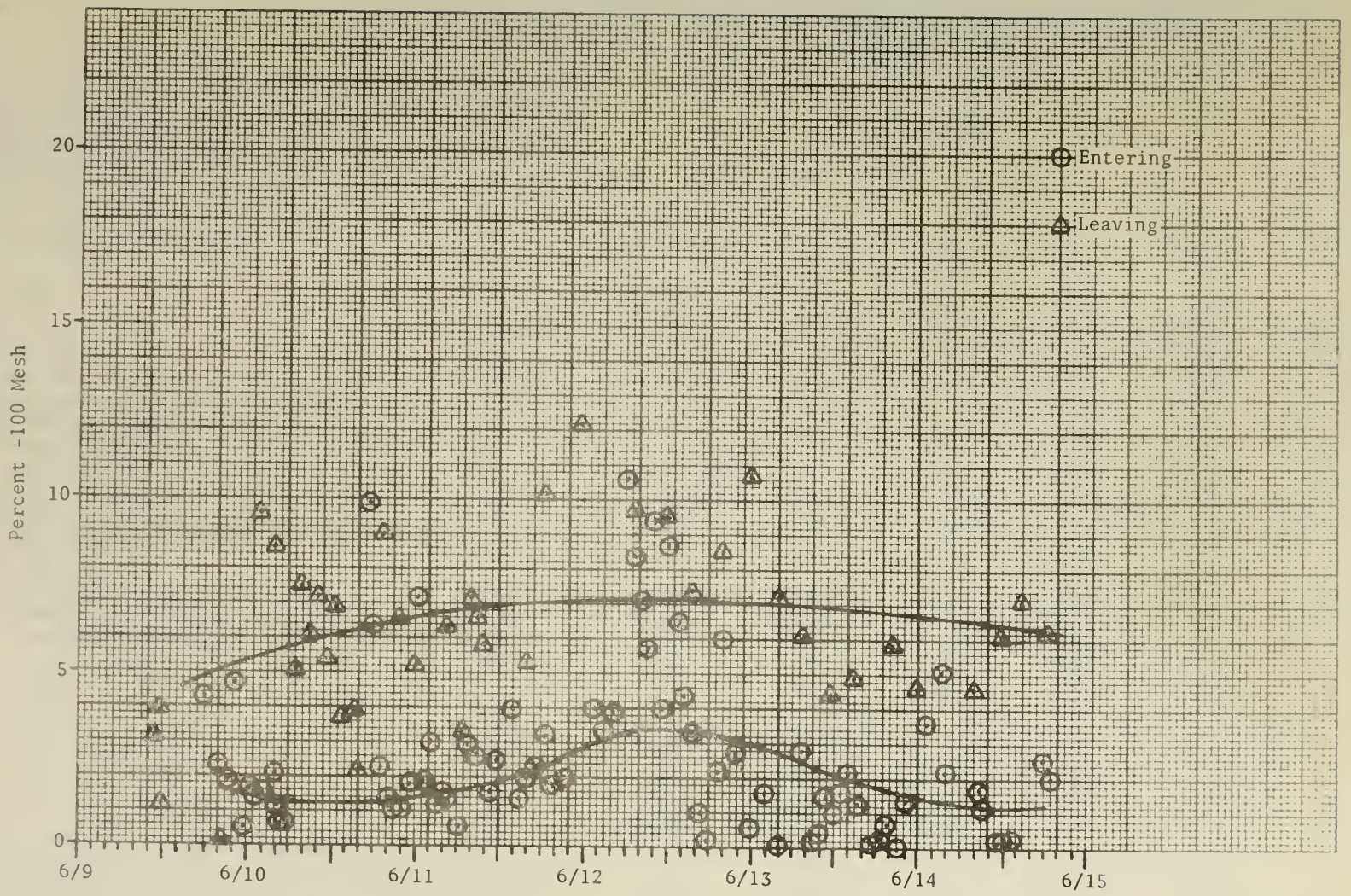

Figure 37-5. -100 MESH MATERIAL ENTERING AND LEAVING THE PREHEATER FOR RUN 37B

Date	← 5/24/76 →		← 5/25/76 →			5/26/76
Time	1430	2300	0700	1500	2300	0700
Jacket Steam Make, lb/hr	20	20	15	23	18	18
Solids	Husky Char	← Rosebud Subbituminous →				
Feedstock						
Feed Rate, lb/hr(1)	1,600	1,910	2,125	2,125	2,125	2,125
Cyclone Solids Dump, lb/hr	271	253	250	219	187	167
Pond Solids, lb/hr	53	57	38	24	17	NA
Gas Flows(2)						
Boot (Recycle), SCFH	16,200	16,400	10,200	7,020	0	0
Boot (Steam), SCFH	20,500	19,000	28,100	37,000	39,700	40,900
Boot (CO_2), SCFH	0	226	976	950	979	978
Side (Steam), SCFH	29,000	29,000	21,000	15,100	15,000	15,000
Side (Air), SCFH	19,600	19,600	8,570	0	0	0
Purges						
Recycle, SCFH	1,840	2,050	2,290	2,260	2,270	2,360
Inert, SCFH	274	274	201	192	256	219
Nitrogen, SCFH(5)	1,448	1,448	1,274	1,470	1,560	1,610
Total Flow In, SCFH	88,900	88,000	72,610	64,100	59,800	61,100
Vent Rate, SCFH	52,900	57,000	49,700	35,900	37,000	40,400
Bed Conditions						
Boot Velocity, ft/sec	1.871	1.925	2.049	2.089	2.035	2.120
Char Bed Inlet Velocity, ft/sec	0.891	0.906	0.725	0.581	0.572	0.591
Boot Density, lb/ft^3(3)	101	102	96	90	86	72
Char Bed Density, lb/ft^3(3)	49	35	35	38	36	37
Boot Temperature, °F	1472	1512	1524	1508	1500	1513
Char Bed Temperature, °F	1470	1495	1495	1494	1498	1511
Overhead Gas Compositions, Mol%						
CO	15.90	15.50	14.80	12.1	12.5	14.3
CO_2	17.10	16.50	8.70	13.3	12.0	9.7
N_2	28.60	27.80	18.40	4.0	4.2	4.8
H_2	33.40	33.30	48.00	57.5	57.6	57.4
CH_4	4.20	6.90	11.10	12.9	13.5	13.6
H_2O Mole Fraction(4)	25.68	26.36	22.17	38.91	35.96	28.84

(1) Determined by feeder RPM: Husky char, 420*RPM; Rosebud coal, 425*RPM
(2) Determined by orifice flow meter measurements
(3) Determined by differential pressure measurements
(4) Calculation based on water-gas shift equilibrium
(5) All nitrogen purges assumed to go to the gasifier

Table 37-1. GASIFIER DATA FOR RUN 37A

Date	5/24/76		5/25/76			5/26/76
Time	1430	2300	0700	1500	2300	0700
Jacket Steam Make, lb/hr	250	320	310	320	310	300
Solids						
Acceptor Feedstock	Dead-Burned Dolomite	← Minnekahta Limestone →				
Acceptor Makeup, lb/hr[1]	360	560	560	560	560	560
Acceptor Withdrawal, lb/hr[3]	334	775	506	347	691	436
Acceptor Circulation, lb/hr[2]	6,690	3,750	9,690	12,100	12,700	11,200
Ash and Attrited Acceptor, lb/hr[3]	← Weigh Scales Out Of Service →			210	273	199
Auxiliary Fuel Char, lb/hr[1]	55	202	129	120	129	221
Gas Flows[4]						
Acceptor Lift, SCFH	55,100	55,300	54,400	54,300	54,500	54,600
Char Lift, SCFH	9,930	9,900	9,780	9,830	9,840	9,900
Air Line						
Recycle, SCFH	40,600	25,100	18,500	10,300	0	0
Air, SCFH	61,200	59,400	71,400	80,560	80,000	75,600
Purges						
Recycle, SCFH	2,600	2,480	2,440	2,200	2,590	2,440
Inert, SCFH[6]	383	265	141	0	174	174
Total Flow In, SCFH	169,800	152,400	156,700	157,200	147,100	143,700
Vent Rate, SCFH	73,900	76,900	88,900	104,000	101,000	98,400
Bed Conditions						
Inlet Gas Velocity, ft/sec	3.116	2.796	2.852	2.900	2.677	2.615
Average Bed Density, lb/ft^3[5]	98	95	89	84	77	69
Average Bed Temperature, ^oF	1845	1845	1826	1849	1830	1843
Overhead Gas Compositions, Mol%						
CO	2.69	2.15	2.06	3.16	3.06	2.51
CO_2	19.99	19.99	25.89	25.46	25.46	25.89
N_2	77.33	77.86	72.05	71.39	71.48	71.61

(1) Determined by feeder RPM: dead-burned dolomite, 360*RPM; limestone, 280*RPM; auxiliary fuel, 368*RPM
(2) Determined by lift line pressure drop measurements
(3) Determined by weigh scale measurements
(4) Determined by orifice flow meter measurements
(5) Determined by pressure tap readings
(6) Dpt-2037 balance gas assumed to go to the regenerator

Table 37-2. REGENERATOR DATA FOR RUN 37A

Date	6/9/76		6/10/76			6/11/76		
Time	1100	1900	0300	1100	1900	0300	1100	1900
Jacket Steam Make, lb/hr	0	45	32	30	29	26	30	26
Solids								
Feedstock	Husky Char			Rosebud Subbituminous				
Feed Rate, lb/hr[1]	1,260	1,050	1,890	2,125	2,125	2,125	2,083	2,125
Cyclone Solids Dump, lb/hr	142	140	180	158	224	161	100	120
Pond Solids	NA	36	NA	153	70	66	51	168
Gas Flows[2]								
Boot (Recycle), SCFH	30,900	21,800	19,900	19,400	14,500	9,780	7,480	6,260
Boot (Steam), SCFH	10,500	18,900	18,900	18,900	23,100	27,900	31,090	31,000
Boot (CO_2), SCFH	0	0	0	0	926	923	917	941
Side (Steam), SCFH	29,600	29,000	28,500	28,400	26,600	20,100	19,300	17,600
Side (Air), SCFH	18,900	19,100	19,000	19,000	13,100	7,300	4,080	2,770
Purges								
Recycle, SCFH	2,060	2,220	1,950	2,000	1,920	2,200	2,400	2,380
Inert, SCFH	164	200	228	219	237	274	219	283
Nitrogen, SCFH[5]	1,540	1,630	1,540	1,450	1,490	1,490	1,680	1,230
Total Flow In, SCFH	93,700	92,850	90,000	89,400	81,900	70,000	67,200	62,500
Vent Rate, SCFH	43,800	54,900	55,900	62,000	58,000	48,700	49,000	44,400
Bed Conditions								
Boot Velocity, ft/sec	1.917	1.912	1.820	1.835	1.839	1.950	2.024	2.012
Char Bed Inlet Velocity, ft/sec	0.879	0.896	0.878	0.880	0.799	0.692	0.662	0.667
Boot Density, lb/ft^3[3]	102	98	95	102	104	95	87	80
Char Bed Density, lb/ft^3[3]	50	44	48	37	36	37	35	38
Boot Temperature, ^oF	1353	1471	1481	1502	1504	1526	1516	1527
Char Bed Temperature, ^oF	1373	1474	1493	1501	1505	1525	1514	1520
Overhead Gas Compositions, Mol%								
CO	10.30	15.70	15.60	14.70	15.00	14.20	11.60	13.10
CO_2	18.70	15.40	15.50	15.00	14.30	11.60	10.30	11.30
N_2	40.00	33.50	34.10	29.50	25.30	23.10	12.60	11.00
H_2	24.50	31.80	31.20	33.30	36.80	40.80	52.50	52.10
CH_4	6.10	3.30	3.40	7.20	8.40	10.10	13.00	12.50
H_2O Mole Fraction[4]	26.00	24.93	27.28	25.36	26.20	25.69	32.22	31.95

(1) Determined by feeder RPM: Husky char, 420*RPM; Rosebud coal, 425*RPM
(2) Determined by orifice flow meter measurements
(3) Determined by differential pressure measurements
(4) Calculation based on water-gas shift equilibrium
(5) All nitrogen purges assumed to go to the gasifier

Table 37-3. GASIFIER DATA FOR RUN 37B (Sheet 1 of 2)

Date	6/12/76			6/13/76			6/14/76		
Time	0300	1100	1900	0300	1300	1900	0300	1100	1900
Jacket Steam Make, lb/hr	26	29	26	26	29	26	24	23	23
Solids									
Feedstock	Rosebud Subbituminous								
Feed Rate, lb/hr[1]	2,125	2,125	2,125	2,125	2,125	1,700	1,743	1,785	1,785
Cyclone Solids Dump, lb/hr	124	104	113	119	105	105	92	88	NA
Pond Solids, lb/hr	37	31	22	30	24	25	25	20	26
Gas Flows[2]									
Boot (Recycle), SCFH	6,520	0	0	0	0	9,610	14,500	13,800	15,200
Boot (Steam), SCFH	28,100	32,700	34,500	33,100	35,800	15,500	17,000	16,500	17,200
Boot (CO_2), SCFH	967	957	941	958	923	932	960	967	525
Side (Steam), SCFH	17,800	20,000	19,900	21,100	21,300	24,200	22,000	22,100	27,200
Side (Air), SCFH	0	0	0	0	0	0	0	0	0
Purges									
Recycle, SCFH	2,050	2,680	2,720	2,980	2,340	3,240	2,350	2,070	2,280
Inert, SCFH	274	274	219	237	192	219	247	228	219
Nitrogen, SCFH[5]	1,120	1,000	780	780	1,450	1,490	940	840	810
Total Flow In, SCFH	56,800	57,600	59,100	59,100	62,000	55,200	58,000	56,500	63,400
Vent Rate, SCFH	37,500	38,300	44,600	43,500	45,200	29,200	35,200	36,800	38,665
Bed Conditions									
Boot Velocity, ft/sec	1.858	1.887	1.977	1.889	2.009	1.945	1.799	1.719	1.866
Char Bed Inlet Velocity, ft/sec	0.566	0.597	0.616	0.609	0.636	0.635	0.597	0.582	0.671
Boot Density, lb/ft^3[3]	78	77	71	68	62	59	54	57	59
Char Bed Density, lb/ft^3[3]	41	39	41	40	36	36	39	41	41
Boot Temperature, ^oF	1523	1514	1520	1506	1513	1528	1547	1537	1527
Char Bed Temperature, ^oF	1513	1509	1521	1505	1511	1515	1519	1512	1520
Overhead Gas Compositions, Mol%									
CO	11.80	12.10	12.80	12.70	13.20	12.50	13.10	10.20	11.80
CO_2	10.00	10.70	10.00	9.60	8.40	6.70	6.50	6.90	3.30
N_2	9.60	6.00	5.50	6.40	5.80	10.70	8.10	15.90	10.20
H_2	54.30	56.70	58.60	58.40	59.10	56.80	58.30	54.00	60.40
CH_4	14.30	14.60	13.10	12.80	13.50	13.30	13.90	13.00	14.20
H_2O Mole Fraction[4]	33.00	34.34	32.56	36.62	28.82	24.75	24.38	28.71	15.75

(1) Determined by feeder RPM: Husky char, 420*RPM; Rosebud coal, 425*RPM
(2) Determined by orifice flow meter measurements
(3) Determined by differential pressure measurements
(4) Calculation based on water-gas shift equilibrium
(5) All nitrogen purges assumed to go to the gasifier

Table 37-3. GASIFIER DATA FOR RUN 37B (Sheet 2 of 2)

Date	6/9/76		6/10/76			6/11/76		
Time	1100	1900	0300	1100	1900	0300	1100	1900
Jacket Steam Make, lb/hr	0	330	330	240	240	330	260	400
Solids								
Acceptor Feedstock	← Dead-Burned Dolomite →				← Minnekahta Limestone →			
Acceptor Makeup, lb/hr[1]	360	360	360	360	560	560	560	560
Acceptor Withdrawal, lb/hr[3]	445	511	442	472	717	501	379	264
Acceptor Circulation, lb/hr[2]	9,720	7,250	12,100	14,000	12,700	11,200	10,000	11,300
Ash and Attrited Acceptor, lb/hr[3]	← Weigh Scales Out Of Service →					103	261	262
Auxiliary Fuel Char, lb/hr[1]	0	16	74	51	239	129	202	110
Gas Flows[4]								
Acceptor Lift, SCFH	55,200	56,200	56,000	55,400	54,700	54,200	54,800	56,400
Char Lift, SCFH	9,620	9,610	9,600	9,600	9,460	9,420	9,580	9,630
Air Line								
Recycle, SCFH	35,500	30,300	23,100	21,800	15,400	10,200	0	0
Air, SCFH	47,600	56,900	62,700	58,600	69,800	75,500	78,600	77,800
Purges								
Recycle, SCFH	2,000	2,010	2,200	2,500	2,480	2,090	1,820	2,370
Inert, SCFH[6]	0	0	0	0	0	0	0	0
Total Flow In, SCFH	149,900	155,000	153,700	147,900	151,800	151,400	144,800	146,200
Vent Rate, SCFH	71,900	70,100	79,400	70,300	90,300	94,800	106,800	108,100
Bed Conditions								
Inlet Gas Velocity, ft/sec	2.787	2.855	2.844	2.699	2.782	2.794	2.668	2.693
Average Bed Density, lb/ft^3[5]	97	97	91	95	95	87	80	72
Average Bed Temperature, ^oF	1864	1844	1858	1832	1839	1849	1843	1851
Overhead Gas Compositions, Mol%								
CO	3.74	3.54	6.45	3.16	3.06	1.64	3.25	2.33
CO_2	15.96	14.79	14.01	16.36	19.58	23.32	22.06	22.06
N_2	80.30	81.67	79.54	80.49	77.36	75.04	74.69	75.62

(1) Determined by feeder RPM: dead-burned dolomite, 360*RPM; limestone, 280*RPM; auxiliary fuel, 368*RPM
(2) Determined by lift line pressure drop measurements
(3) Determined by weigh scale measurements
(4) Determined by orifice flow meter measurements
(5) Determined by pressure tap readings
(6) Dpt-2037 balance gas assumed to go to the regenerator

Table 37-4. REGENERATOR DATA FOR RUN 37B (Sheet 1 of 2)

Date	6/12/76			6/13/76			6/14/76		
Time	0300	1100	1900	0300	1300	1900	0300	1100	1900
Jacket Steam Make, lb/hr	210	210	200	220	240	300	445	445	440
Solids									
Acceptor Feedstock	Minnekahta Limestone								
Acceptor Makeup, lb/hr[1]	560	560	560	560	560	840	560	560	560
Acceptor Withdrawal, lb/hr[3]	316	503	292	392	848	394	372	212	213
Acceptor Circulation, lb/hr[2]	8,800	10,200	9,700	8,180	10,600	10,600	8,810	8,160	8,190
Ash and Attrited Acceptor, lb/hr[3]	NA	NA	207	204	177	183	319	260	233
Auxiliary Fuel Char, lb/hr[1]	92	239	55	239	175	147	45	55	184
Gas Flows[4]									
Acceptor Lift, SCFH	55,800	56,300	56,300	56,100	55,500	54,500	56,700	57,800	56,600
Char Lift, SCFH	9,700	9,670	9,630	9,700	9,550	9,640	9,700	9,700	9,670
Air Line									
Recycle, SCFH	0	0	0	0	0	0	0	0	0
Air, SCFH	80,900	82,300	77,200	85,700	81,100	81,800	74,300	72,100	77,680
Purges									
Recycle, SCFH	2,860	3,040	2,410	2,450	2,210	2,850	3,200	3,000	2,450
Inert, SCFH[6]	224	111	298	0	0	627	0	0	174
Total Flow In, SCFH	149,500	151,400	145,700	153,950	148,400	149,400	143,900	142,600	146,600
Vent Rate, SCFH	112,200	103,600	103,000	114,000	109,000	116,700	102,200	99,700	103,200
Bed Conditions									
Inlet Gas Velocity, ft/sec[5]	2.751	2.748	2.663	2.820	2.715	2.708	2.643	2.608	2.681
Average Bed Density, lb/ft^3	69	71	68	69	59	49	60	58	62
Average Bed Temperature, ^{o}F	1859	1829	1837	1837	1833	1829	1859	1846	1839
Overhead Gas Compositions, Mol%									
CO	2.24	4.14	1.72	3.74	2.51	3.16	1.81	2.15	3.54
CO_2	22.48	23.74	23.32	24.60	23.74	23.74	22.90	16.36	23.74
N_2	75.29	72.11	74.96	71.66	73.75	73.10	75.30	81.49	72.71

(1)(2) Determined by feeder RPM: dead-burned dolomite, 360*RPM; limestone, 280*RPM; auxiliary fuel, 368*RPM
(3) Determined by lift line pressure drop measurements
(4) Determined by weigh scale measurements
(5) Determined by orifice flow meter measurements
(6) Dpt-2037 balance gas assumed to go to the regenerator

Table 37-4. REGENERATOR DATA FOR RUN 37B (Sheet 2 of 2)

Date 5/21/76 - 5/26/76

Screen Size, Wt % Tyler Mesh	Acceptor: Dead-Burned Dolomite	Acceptor: Minnekahta Limestone	Screen Size, Wt % Tyler Mesh	Coal: Husky Char	Coal: Rosebud Subbituminous
+4	↓	↓	+6	↓	↓
4 X 6			6 X 8		
6 X 8			8 X 10		
8 X 9	1.0	61.0	10 X 14		
9 X 10	↓	↓	14 X 20	22.7	7.2
10 X 12	43.1	36.3	20 X 28	↓	↓
12 X 14	26.8	1.7	28 X 35		
14 X 16	↓	↓	35 X 48	52.4	41.2
16 X 20	26.8	0.1	48 X 65	↓	↓
20 X 24	↓	↓	65 X 100	18.0	31.3
24 X 28	1.5	0.2	100 X 200	↓	↓
-28	1.0	0.7	-200	6.9	20.3
Ultimate Analysis, Wt %					
Moisture				1.4	8.5
C				76.7	59.0
H				2.6	5.0
S				0.69	0.8
N				1.64	0.54
Ash + SO_3				17.13	6.5
Elemental Analysis, Wt %					
SiO_2	3.86	3.97		34.13	35.75
SO_3	0.84	0.14		23.52	17.37
Na_2O	0.17	0.14		4.12	0.51
CaO	52.98	90.76		17.70	25.34
MgO	38.69	3.26		5.86	5.53
K_2O	0.01	0.10		0.43	0.14
P_2O_5	-	-		0.03	0.08
Al_2O_3	1.37	0.90		0.03	12.15
Fe_2O_3	1.82	0.36		9.41	2.20
TiO_2	-	-		0.12	0.21

Table 37-5. FEEDSTOCK COMPOSITES FOR RUN 37A

Date 6/2/76 - 6/14/76

Screen Size, Wt % Tyler Mesh	Acceptor: Dead-Burned Dolomite[1]	Acceptor: Minnekahta Limestone	Screen Size, Wt % Tyler Mesh	Coal: Husky Char	Coal: Rosebud Subbituminous
+4			+6		
4 X 6			6 X 8		
6 X 8			8 X 10		
8 X 9	1.0	75.8	10 X 14		
9 X 10	↓	↓	14 X 20	34.3	22.8
10 X 12	43.1	24.0	20 X 28	↓	↓
12 X 14	26.8	Tr	28 X 35		
14 X 16	↓	↓	35 X 48	44.9	56.3
16 X 20	26.8	Tr	48 X 65	↓	↓
20 X 24	↓	↓	65 X 100	11.6	15.2
24 X 28	1.5	Tr	100 X 200	↓	↓
-28	1.0	0.2	-200	9.2	5.7
Ultimate Analysis, Wt %					
Moisture				3.99	0
C				67.84	68.41
H				3.09	3.98
S				0.71	0.90
N				1.11	0.72
Ash + SO_3				14.19	10.39
Elemental Analysis, Wt %					
SiO_2	3.86	3.48		40.79	48.12
SO_3	0.84	0.12		19.16	11.52
Na_2O	0.17	0.05		2.24	0.29
CaO	52.98	93.88		18.21	17.19
MgO	38.69	0.85		3.93	3.82
K_2O	0.01	0.10		0.27	0.19
P_2O_5	-	0.94		8.34	0.26
Al_2O_3	1.37	0.33		6.38	12.59
Fe_2O_3	1.82	0.04		0.09	4.97
TiO_2	-	0.07		0.31	0.60

[1] Analysis from Run 37A

Table 37-6. FEEDSTOCK COMPOSITES FOR RUN 37B

Date	5/24/76		← 5/25/76 →			← 5/26/76 →	
Time	0800	1600	0000	0800	1600	0000	← 0800 →
Screen Size, Wt %							
Tyler Mesh							
+4				Tr			0.4
4 X 6				3.7			17.2
6 X 8				4.6	17.7	28.7	16.4
8 X 9	0.2	0.4	0.4	8.0			15.9
9 X 10				35.5	43.8	41.9	22.2
10 X 12	36.0	42.7	51.0	28.1	22.6	17.3	15.7
12 X 14	33.2	33.9	32.0	13.2			7.3
14 X 16				4.2	14.7	9.8	2.1
16 X 20	28.9	22.1	15.8	0.5			0.5
20 X 24				0.4	0.5	0.5	0.2
24 X 28	1.2	0.6	0.3	1.6	0.7	1.7	2.0
-28	0.5	0.4	0.4				
% Calcine Weight Change	-2.2	-1.0		0	-0.2	0	-1.2
Elemental Analysis, Wt %							
SiO_2	2.26	3.40		4.49	5.96	6.65	33.11
SO_3	0.87	0.76		0.65	0.75	1.13	1.74
Na_2O	0.09	0.10		0.12	0.10	0.04	0.49
CaO	53.79	54.66		55.52	61.41	73.17	49.04
MgO	40.32	37.86		35.39	27.64	14.89	8.06
K_2O	0.02	0.02		0.02	0.02	0.01	0.13
P_2O_5	-	-		-	-	-	-
Al_2O_3	0.66	1.30		1.41	1.97	1.93	4.15
Fe_2O_3	1.76	1.87		1.96	1.78	1.41	2.68

Table 37-7. CIRCULATED, CALCINED ACCEPTOR FOR RUN 37A

Date	6/9/76	← 6/10/76 →			← 6/11/76 →			← 6/12/76 →		
Time	1600	0000	0800	1000	0000	0800	1600	0030	0800	1600
Screen Size, Wt %										
Tyler Mesh										
+4						↓			↓	
4 X 6						0.5			1.2	
6 X 8						3.5			14.0	
8 X 9	0.8	0.4	1.7	2.7	9.6	4.5	20.4	22.1	12.7	37.5
9 X 10	↓	↓	↓	↓	↓	8.6	↓	↓	13.6	↓
10 X 12	53.8	50.4	59.9	54.8	42.5	31.5	41.2	40.6	21.2	33.8
12 X 14	28.1	29.4	26.3	27.5	26.2	26.7	21.3	17.8	16.8	11.0
14 X 16	↓	↓	↓	↓	↓	16.9	↓	↓	9.9	↓
16 X 20	16.1	18.4	11.4	14.2	18.7	5.9	14.4	15.4	4.6	12.4
20 X 24	↓	↓	↓	↓	↓	1.0	↓	↓	1.7	↓
24 X 28	0.7	0.8	0.3	0.4	1.2	0.3	1.2	1.9	1.1	3.0
-28	0.6	0.6	0.4	0.4	1.9	0.6	1.5	2.1	3.1	2.2
% Calcine Weight Change						-0.4			-1.0	
Elemental Analysis, Wt %										
S^{-2}						0.05			0.07	
SiO_2						4.10			5.75	
SO_3						0.25			0.19	
Na_2O						0.07			0.05	
CaO										
MgO										
K_2O										
P_2O_5										
Al_2O_3										
Fe_2O_3										
TiO_2										

Table 37-8. CIRCULATED, CALCINED ACCEPTOR FOR RUN 37B (Sheet 1 of 2)

Date	← 6/13/76 →			← 6/14/76 →						
Time	0000	0800	1600	← 0000 →					0800	1600
Screen Size, Wt %										
Tyler Mesh										
+4		↓							↓	
4 X 6		1.9							5.0	
6 X 8		23.1							28.4	36.7
8 X 9	50.0	21.3	46.8	65.1					20.2	↓
9 X 10	↓	16.9	↓		↓				15.3	33.1
10 X 12	32.0	15.1	34.4		25.7				11.1	↓
12 X 14	6.5	9.4	8.0		4.3				8.0	18.9
14 X 16	↓	4.9	↓			↓			4.1	↓
16 X 20	6.8	2.5	6.6			3.2			2.3	6.2
20 X 24	↓	1.6	↓				↓		1.6	↓
24 X 28	2.5	1.0	2.3				1.3		0.9	2.6
-28	2.1	2.2	1.8					↓	3.0	2.4
% Calcine Weight Change		-2.4		-0.6	-0.3	-0.6	-1.3	-2.8	-1.8	
Elemental Analysis, Wt %										
S^{-2}		0.12							0.07	
SiO_2		7.01		8.96	10.63	16.30	31.52	36.11	8.90	
SO_3		0.50		0.57	0.54	0.64	0.91	1.22	1.12	
Na_2O		0.04		0.23	0.09	0.20	0.66	0.51	0.06	
CaO				83.78	70.45	66.84	54.25	49.33		
MgO				2.39	13.48	9.45	3.15	2.70		
K_2O				0.02	0.02	0.06	0.10	0.11		
Al_2O_3				1.95	2.22	3.41	6.15	5.90		
Fe_2O_3				0.76	1.82	2.21	2.81	2.81		
P_2O_5				0.05	0.05	0.06	0.13	0.13		
TiO_2				0.15	0.20	0.23	0.29	0.26		

Table 37-8. CIRCULATED, CALCINED ACCEPTOR FOR RUN 37B (Sheet 2 of 2)

Date	← 5/24/76 →				← 5/25/76 →			← 5/26/76 →				
Time	0740		1600		0000	0800	1600	0000	← 0800 →			
Screen Size, Wt % Tyler Mesh												
+4	↓		↓		↓	↓						
4 X 6												
6 X 8	0.1		0.1			2.7						
8 X 9	0.3		0.3		0.3	2.9		17.6	18.5	22.5		
9 X 10	3.9		5.5		↓	7.2		↓	↓		↓	
10 X 12	30.9		32.6		45.4	32.7		40.7	40.9		33.7	
12 X 14	24.9		33.7		31.3	28.6		20.0	18.6			15.0
14 X 16	8.3		20.0		↓	17.7		↓	↓			↓
16 X 20	0.8		5.8		21.4	6.7		16.9	16.0			17.9
20 X 24		0.8		0.8	↓		0.9	↓	↓			
24 X 28		0.8		0.7	0.9		0.3	1.9	2.5			4.8
-28		1.0		0.5	0.7		0.2	2.3	3.6			6.1
Particle Density, lb/ft^3						185		150	157			
% Calcine Weight Change	-4.8		-5.4	-24.8		-6.2	-15.9			-13.1	-7.3	-3.0	-3.5	-12.1
Activity						0.06		0.08	0.11					
Elemental Analysis, Wt %														
S^{-2}										0.09	0.06	0.03	0.02	
SiO_2	1.56	14.36	2.94	21.80		4.35	29.27	6.15		4.84	4.60	3.23	6.38	26.17
SO_3	1.64	6.04	1.61	4.11		1.63	2.01	1.22		0.52	0.29	0.20	0.25	0.96
Na_2O	0.08	0.49	0.08	0.58		0.08	0.67	0.09		0.02	0.02	0.03	0.05	0.21
CaO	52.60	41.93	54.11	41.12		55.61	40.18	61.39		89.86	65.53	64.68	62.77	57.66
MgO	41.22	29.00	37.40	24.43		32.85	19.26	26.35		1.68	25.78	27.79	25.15	6.16
K_2O	0.02	0.09	0.02	0.11		0.01	0.12	0.01		0.01	0.01	0.01	0.01	0.09
P_2O_5	-	-	-	-		-	-	-		0.03	0.02	0.02	0.03	0.05
Al_2O_3	1.00	2.17	1.46	3.07		1.91	3.98	2.04		1.62	1.70	1.58	1.94	4.46
Fe_2O_3	1.78	5.62	2.20	4.92		2.64	4.20	2.00		0.62	1.42	1.70	1.95	3.87
TiO_2	-	-	-	-		-	-	-		0.04	0.06	0.05	0.08	0.15

Table 37-9. CIRCULATED, RECARBONATED ACCEPTOR FOR RUN 37A

Date	6/9/76	← 6/10/76 →			← 6/11/76 →			← 6/12/76 →			
Time	1600	0000	0800	1545	0000	0800	1600	0000	0800	1600	2330
Screen Size, Wt %											
Tyler Mesh											
+4						↓					
4 X 6						0.5			1.1		
6 X 8						3.5			14.9		
8 X 9	0.3	0.2	0.7	0	9.6	4.5	15.5	16.8	15.0	27.9	27.0
9 X 10	↓	↓	↓	↓	↓	8.6	↓	↓	15.8	↓	↓
10 X 12	28.1	43.8	44.5	37.4	42.5	31.5	39.9	40.6	3.6	38.3	35.4
12 X 14	56.2	30.6	29.8	31.0	26.2	26.7	21.7	19.7	23.4	15.1	13.1
14 X 16	↓	↓	↓	↓	↓	16.9	↓	↓	14.1	↓	↓
16 X 20	14.9	23.4	22.2	28.4	18.7	5.9	19.3	17.4	6.7	14.1	13.5
20 X 24	↓	↓	↓	↓	↓	1.0	↓	↓	2.3	↓	↓
24 X 28	0.4	1.4	1.7	1.7	1.2	0.3	2.2	2.7	1.4	3.3	5.4
-28	0.1	0.5	1.1	1.4	1.9	0.6	1.4	2.7	1.7	1.2	5.6
Particle Density, lb/ft^3						150	173	154	120	135	123
% Calcine Weight Change						-4.6			-7.7		
Activity						0.06	0.12	0.13	0.12	0.12	0.13
Elemental Analysis, Wt %											
SiO_2						4.45			7.05		
SO_3						0.22			0.34		
Na_2O						0.05			0.04		
CaO						56.92			74.23		
MgO						34.19			14.64		
K_2O						0.02			0.02		
Al_2O_3						0.03			1.87		
Fe_2O_3						1.43			1.50		
P_2O_5						1.61			0.04		
TiO_2						0.12			0.12		

Table 37-10. CIRCULATED, RECARBONATED ACCEPTOR FOR RUN 37B (Sheet 1 of 2)

Date	6/13/76							6/14/76	
Time	0800	1600	2330					0800	1600
Screen Size, Wt % Tyler Mesh									
+4	↓		↓					↓	
4 X 6	0.7		2.5					4.2	
6 X 8	11.3	↓	19.6					22.3	29.6
8 X 9	13.8	30.4	17.2					20.3	↓
9 X 10	16.1	↓	16.4					17.3	33.7
10 X 12	18.8	34.6		13.1				14.0	↓
12 X 14	13.9	10.6		8.0				9.2	23.1
14 X 16	8.4	↓			5.7			5.1	↓
16 X 20	4.9	11.6			3.8			3.1	7.8
20 X 24	3.3	↓				3.0		1.9	↓
24 X 28	2.8	6.1				2.6		1.1	3.1
-28	6.0	6.7					8.1	1.5	2.6
Particle Density, lb/ft^3	122	116	108	120	121	133	123	114	108
% Calcine Weight Change	-7.4							-6.9	
Activity	0.10	0.10						0.11	0.10
Elemental Analysis, Wt %									
SiO_2	8.91							9.44	
SO_3	0.70							0.94	
Na_2O	0.05							0.07	
CaO	73.20							76.24	
MgO	12.87							6.81	
K_2O	0.02							0.02	
Al_2O_3	0.05							3.51	
Fe_2O_3	1.99							1.78	
P_2O_5	1.67							0.06	
TiO_2	0.20							0.17	

Table 37-10. CIRCULATED, RECARBONATED ACCEPTOR FOR RUN 37B (Sheet 2 of 2)

Date	← 5/24/76 →			← 5/25/76 →					← 5/26/76 →			
Time	0400		1100	0400		1200		2000	0400		1600	
Sample	S-13B[1] Mix	S-13B Acceptor	S-13B Mix	S-13B Mix	S-13B Acceptor	S-13B Mix	S-13B Acceptor	S-13B Mix	S-13B Acceptor	S-13B Mix	S-13C[2] Mix	S-13B Mix
Screen Size, Wt %												
Tyler Mesh												
+8	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
8 X 9	0.1	2.8	Tr	1.2	3.8	4.6	10.3	7.4	18.0	10.3	23.9	20.1	0
9 X 12	8.5	31.7	15.7	16.3	36.8	14.7	34.6	17.6	36.0	18.5	38.0	34.5	0.8
12 X 14	9.7	28.1	10.4	12.6	24.1	10.8	20.5	9.6	16.0	8.8	15.0	17.5	0.3
14 X 20	16.3	28.6	17.1	14.3	24.4	13.7	23.1	12.5	15.0	8.5	9.7	15.6	1.5
20 X 28	10.7	2.0	7.1	4.7	2.3	4.4	2.6	4.7	4.0	4.3	3.8	3.2	5.9
28 X 35	16.9	↓	13.0	12.1	↓	11.7	↓	10.7	↓	10.9	↓	2.6	18.1
35 X 48	16.0	↓	14.2	16.3	↓	15.4	↓	14.9	↓	14.6	↓	1.8	28.1
48 X 65	9.9	6.7	9.0	11.5	7.8	11.0	9.0	10.5	11.0	11.1	9.7	0.8	22.4
65 X 80	↓	0.1	↓	↓	0.8	↓	0	↓	Tr	↓	Tr	↓	↓
80 X 100	0.1		Tr	0.1	↓	0.1	↓	0.1	↓	0.6	↓	0.1	3.2
100 X 200	1.8		0.7	1.9	↓	0.2	↓	0.1	↓	1.3	↓	0.1	4.3
200 X 325	9.7		11.9	8.7	↓	12.7	↓	11.6	↓	10.8	↓	2.2	14.2
-325	0.2		0.9	0.3	Tr	0.7	0	0.3	Tr	0.2	Tr	1.4	1.3
% Acceptor	35		44	42.9		48.3		46.3		51.0		
% Ash + SO_3 in Char	17.71			22.72		16.44		14.81		14.94		
Ash Elemental Analysis, Wt %												
SiO_2	32.08			44.60				51.81		58.90		
SO_3	17.35			6.57				3.23		2.74		
Na_2O	3.84			3.03				1.26		0.64		

(1) S-13B sample is from the middle of the char bed.
(2) S-13C sample is from the bottom of the char bed in the transition section.

Table 37-11. GASIFIER CHAR BED MATERIAL FOR RUN 37A

Date	6/9/76	← 6/10/76 →			← 6/11/76 →							
Time	1200	1945	0300	1230	1950		0330		1200		2000	
Sample	S-13B[1] Mix	S-13B Mix	S-13B Mix	S-13B Mix	S-13B Mix	S-13B Acceptor	S-13B Mix	S-13B Acceptor	S-13B Mix	S-13B Acceptor	S-13B Mix	S-13B Acceptor
Screen Size, Wt % Tyler Mesh												
+8	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
8 X 9	0.4	0.1	0.4	0.1	0.9	25.2	3.3	3.3	4.7	1.2	8.4	1.0
9 X 10	17.8	20.5	23.1	13.8	18.1	28.6	16.8	5.2	16.1	3.7	↓	↓
10 X 12	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	18.8	65.0
12 X 14	12.6	13.9	18.3	10.4	14.3	12.3	12.3	32.7	10.1	33.3	10.0	4.0
14 X 20	15.0	18.5	21.0	12.5	17.3	9.7	15.5	19.6	13.0	19.8	11.7	4.0
20 X 28	9.5	10.7	6.6	4.9	5.3	16.3	6.7	28.8	6.9	25.9	6.0	17.0
28 X 35	13.5	11.3	9.5	32.0	11.0	↓	12.9	↓	13.8	↓	9.8	↓
35 X 48	11.4	10.2	8.9	11.2	13.0	↓	15.4	↓	15.8	↓	11.5	↓
48 X 65	7.6	5.8	4.9	7.5	9.8	5.3	9.2	9.8	9.9	14.8	7.2	9.0
65 X 80	↓	↓	↓	↓	↓	0.4	↓	0.6	↓	1.2	↓	0
80 X 100	3.3	0.3	0.2	0.2	0.1	↓	0.2	↓	0.6	↓	11.9	↓
100 X 200	3.5	0.3	0.2	0.7	7.0	↓	0.1	↓	0.3	↓	2.7	↓
200 X 325	4.0	7.0	5.8	5.8	1.9	↓	7.0	↓	7.5	↓	0.6	↓
-325	1.0	1.3	1.2	0.8	1.3	2.2	0.6	Tr		Tr	1.4	Tr
% Acceptor	41.0	47.0	54.0	32.0	44.4		50.3		47.2		60.8	
% Ash + SO_3 in Char					17.9		14.4		15.0		15.9	
Ash Elemental Analysis, Wt %												
SiO_2									46.64			
SO_3									4.74			
Na_2O									0.88			

[1] S-13B sample from middle of char bed.

Table 37-12. GASIFIER CHAR BED MATERIAL FOR RUN 37B (Sheet 1 of 3)

Date	6/11/76		← 6/12/76 →								6/13/76	
Time	2200		0430		1200		1900		2000		0400	
Sample	S-13C(2)		S-13B(1)		S-13B		S-13B		S-13B		S-13B	
	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor
Screen Size, Wt %												
Tyler Mesh												
+8	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
8 X 9	9.9	29.3	10.4	32.9	11.9	15.9	17.7	29.1	14.9	12.5	15.3	15.4
9 X 10	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
10 X 12	21.6	32.2	21.7	34.7	21.2	12.7	24.2	33.1	22.0	13.7	22.5	17.1
12 X 14	13.0	8.4	9.8	7.5	10.0	30.2	8.5	10.0	8.4	32.1	6.1	30.8
14 X 20	12.2	18.4	11.4	3.3	11.3	11.6	11.0	16.3	10.7	11.3	8.2	10.2
20 X 28	6.5	4.2	6.3	14.1	7.2	20.6	6.8	5.2	6.5	20.2	6.6	21.4
28 X 35	10.9	↓	10.4	↓	11.6	↓	9.6	↓	10.1	↓	11.3	↓
35 X 48	12.0	↓	12.3	↓	12.5	↓	9.8	↓	10.8	↓	12.1	↓
48 X 65	7.2	7.5	8.3	7.5	7.8	9.0	6.0	6.4	7.0	10.1	8.1	4.3
65 X 80	↓	Tr	↓	Tr	↓	↓	↓	Tr	↓	Tr	↓	0.8
80 X 100	4.0	↓	5.4	↓	4.4	↓	3.9	↓	4.8	↓	5.6	↓
100 X 200	1.9	↓	3.0	↓	1.8	↓	2.0	↓	2.9	↓	3.1	↓
200 X 325	0.4	↓	0.6	↓	0.2	↓	0.3	↓	1.7	↓	0.5	↓
-325	0.3	Tr	0.3	Tr	0.1	Tr	0.3	Tr	1.1	Tr	0.6	Tr
% Acceptor	63.6		61.4		65.5		61.5		65.7		59.2	
% Ash + SO_3 in Char	11.56		12.4		10.7		13.0		11.8		14.5	
Ash Elemental Analysis, Wt %												
SiO_2	53.34						52.83		52.80			
SO_3	3.24						2.24		3.21			
Na_2O	0.47						0.23		0.59			

(1) S-13B sample from middle of char bed.
(2) S-13C sample from bottom of char bed in the transition section.

Table 37-12. GASIFIER CHAR BED MATERIAL FOR RUN 37B (Sheet 2 of 3)

Date	6/13/76						6/14/76					
Time	1215		1800		2000		0400		1200		1830	
Sample	S-13B[1]		S-13C[2]		S-13B		S-13B		S-13B		S-13C	
	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor
Screen Size, Wt % Tyler Mesh												
+8	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	18.0	↓
8 X 9	16.4	7.6	20.5	20.5	18.1	19.0	20.7	23.8	21.3	20.8	↓	38.8
9 X 10	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	19.4	↓
10 X 12	20.3	18.9	21.2	18.8	21.3	16.4	20.2	19.6	19.4	17.3	↓	37.5
12 X 14	5.5	31.1	5.5	27.4	4.8	28.4	3.4	28.0	4.4	25.6	16.0	6.3
14 X 20	7.6	9.1	8.2	6.0	7.8	6.9	5.9	4.2	7.1	19.6	6.2	8.3
20 X 28	7.2	19.7	6.8	15.4	7.0	16.4	7.3	14.0	7.3	6.0	6.4	3.3
28 X 35	12.6	↓	11.6	↓	11.2	↓	11.8	↓	11.9	↓	8.7	↓
35 X 48	13.4	↓	11.9	↓	12.6	↓	12.3	↓	12.9	↓	12.3	↓
48 X 65	8.6	13.6	7.0	12.0	8.2	12.9	8.1	10.5	8.1	10.7	6.4	5.8
65 X 80	↓	Tr	↓	Tr	↓	Tr	↓	Tr	↓	Tr	↓	Tr
80 X 100	5.3	↓	4.3	↓	5.5	↓	5.6	↓	4.9	↓	4.0	↓
100 X 200	2.4	↓	2.2	↓	1.0	↓	3.4	↓	2.2	↓	2.1	↓
200 X 325	0.5	↓	0.3	↓	0.8	↓	0.8	↓	0.3	↓	0.2	↓
-325	0.5	Tr	0.6	Tr	1.9	Tr	0.6	Tr	0.3	Tr	0.2	Tr
% Acceptor	57.7		61.3		57.4		63.7		61.0		66.2	
% Ash + SO_3 in Char	13.4		18.5		18.6		12.2		14.4		14.4	
Ash Elemental Analysis, Wt %												
SiO_2					46.93						47.00	
SO_3					4.53						4.36	
Na_2O					0.76						0.74	

(1) S-13B sample from middle of char bed.
(2) S-13C sample from bottom of char bed in the transition section.

Table 37-12. GASIFIER CHAR BED MATERIAL FOR RUN 37B (Sheet 3 of 3)

Date	5/24/76		← 5/25/76 →				5/26/76	
Time	1130	1720	0145	0900	1400	1900	0200	0545
Screen Size, Wt %								
Tyler Mesh								
+35	0.4	0.4	0.6	0.6	1.2	0.4	0	0
35 X 48	0.3	0.4	0.3	0.6	1.2	0.6	0.1	0
48 X 65	0.4	1.3	2.6	1.6	1.4	0.4	0.8	0.7
65 X 100	0.3	1.0	0.3	3.3	0.3	0.1	3.3	8.1
100 X 200	38.7	49.2	48.5	21.0	1.4	20.2	37.1	50.6
200 X 325	27.4	18.8	29.4	45.4	67.4	50.9	37.3	16.9
-325	32.5	28.9	18.4	27.5	28.2	27.4	21.5	23.6
Ultimate Analysis, Wt %								
C		66.9		68.0		66.4		66.9
H		1.1		1.1		1.5		1.4
N		-		-		0.40		-
Total S		1.11		0.48		0.63		0.34
Ash + SO_3		29.49		27.10		24.05		25.35
Elemental Analysis, Wt %								
SiO_2		38.94		37.67		51.25		44.70
SO_3		10.69		6.62		6.77		3.20
Na_2O		3.49		1.81		0.44		0.62
CaO		18.69		22.42		21.25		27.02
MgO		7.35		8.13		4.43		5.37
K_2O		0.39		0.31		0.09		0.18
P_2O_5		-		-		0.09		0.14
Al_2O_3		11.84		13.92		8.63		11.44
Fe_2O_3		8.07		8.99		6.34		6.52
TiO_2		-		-		0.42		0.34

Table 37-13. GASIFIER CHAR TO EXTERNAL CYCLONE FOR RUN 37A

Date	6/9/76	← 6/10/76 →			← 6/11/76 →			← 6/12/76 →			6/13/76		6/14/76
Time	1200	0200	1230	2105	0300	1230	2105	0500	1200	2100	0500	1215	1200
Screen Size, Wt %													
Tyler Mesh													
+35	1.8	0	0.2	1.0	0.7	0	1.2	0.6	0.3	0.2	0	0.2	0.3
35 X 48	1.1	0.6	0.6	0.8	1.1	0.4	0.5	0.6	0.3	0.2	0	0.2	0.3
48 X 65	1.1	4.5	6.1	2.0	4.2	4.2	2.5	1.2	0.9	0.7	0.7	1.1	0.5
65 X 100	2.3	0.5	8.8	0.2	0.4	0.3	12.0	8.7	8.4	8.0	8.2	12.3	5.2
100 X 200	36.2	15.7	30.6	14.0	15.8	15.6	28.6	32.3	35.5	35.3	32.3	38.1	30.8
200 X 325	25.4	53.5	28.1	44.0	41.0	45.3	12.5	16.4	16.5	15.2	16.0	13.4	14.0
-325	32.1	25.3	25.5	38.0	36.7	34.2	42.7	40.2	38.1	40.4	42.9	34.8	48.9
Ultimate Analysis, Wt %													
C						65.06		62.06			62.09		54.77
H						1.21		1.41			0.90		0.64
N						0.33		0.31			0.29		0.28
Total S						0.44		0.53			0.56		0.84
Ash + SO_3						31.44		34.45			34.24		43.56
Elemental Analysis, Wt %													
SiO_2						45.72		46.47			47.90		35.79
SO_3						3.58		4.01			4.02		5.14
Na_2O						0.34		0.18			0.19		0.20
CaO						28.27		28.80			27.07		41.10
MgO						5.78		4.24			3.62		3.24
K_2O						0.10		0.06			0.07		0.11
P_2O_5						0.16		0.23			0.15		0.14
Al_2O_3						9.63		7.42			9.21		6.95
Fe_2O_3						6.08		6.23			6.60		5.97
TiO_2						0.62		0.42			0.56		0.52

Table 37-14. GASIFIER CHAR TO EXTERNAL CYCLONE FOR RUN 37B

Date	5/24/76	5/25/76
Screen Size, Wt %		
Tyler Mesh		
+35	0.3	0.3
35 X 48	0.3	0.3
48 X 65	0.8	0.3
65 X 100	0.5	0.3
100 X 200	2.3	1.0
200 X 325	60.9	63.4
-325	34.9	34.3
Ultimate Analysis, Wt %		
C	55.9	61.9
H	1.1	1.3
N	0.36	
Total S	1.26	0.47
Ash + SO_3	38.12	31.93
Elemental Analysis, Wt %		
SiO_2	35.80	41.95
SO_3	10.08	5.89
Na_2O	2.25	0.88
CaO	28.14	27.09
MgO	4.57	2.95
K_2O	0.26	0.36
Al_2O_3	12.33	10.73
Fe_2O_3	6.56	9.80

Table 37-15. GASIFIER CHAR TO ORGANIC POND COMPOSITES FOR RUN 37A

Date	6/10/76	6/11/76	6/12/76	6/13/76	6/14/76
Screen Size, Wt %					
Tyler Mesh					
+35	5.9	1.6	2.6	0.7	0.8
35 X 48	2.8	12.8	6.0	0.7	0.8
48 X 65	16.8	21.4	22.6	0.4	0.8
65 X 100	1.1	15.1	21.7	1.8	0.8
100 X 200	10.1	14.7	22.6	36.7	10.3
200 X 325	53.0	27.0	20.4	49.5	59.7
-325	10.4	7.4	4.1	10.2	26.7
Ultimate Analysis, Wt %					
C	49.23	52.12	52.61	62.33	62.40
H	1.43	2.31	2.42	1.12	1.10
N	0.63	0.46	0.45	0.30	0.23
Total S	1.67	1.39	1.04	0.72	0.71
Ash + SO_3	30.05	31.96	36.84	27.96	34.23
Elemental Analysis, Wt %					
SiO_2	34.70	30.25	40.21	33.58	26.55
SO_3	17.55	12.46	6.86	6.69	5.30
Na_2O	0.56	0.58	0.48	0.56	0.51
CaO	16.18	29.44	33.75	32.67	41.12
MgO	1.97	3.19	2.72	2.96	2.75
K_2O	0.10	0.18	0.21	0.36	0.32
P_2O_5	0.23	0.40	0.27	0.43	0.42
Al_2O_3	9.68	12.58	9.58	14.62	14.56
Fe_2O_3	18.23	9.98	4.82	7.31	7.19
TiO_2	0.58	0.66	0.42	0.74	0.66

Table 37-16. GASIFIER CHAR TO ORGANIC POND COMPOSITES FOR RUN 37B

Date	← 5/24/76 →			← 5/25/76 →				5/26/76
Time	0615	1750	2225	0510	1410	1700	2100	0320
Screen Size, Wt %								
Tyler Mesh								
+9	Tr	0.2	Tr	0.1	1.9	10.2	12.4	15.7
9 X 12	24.8	32.3	38.1	38.7	37.9	43.1	46.7	50.9
12 X 14	33.7	35.0	33.4	33.6	31.0	25.1	23.4	19.2
14 X 20	39.7	31.2	27.3	26.5	27.5	19.0	15.5	12.5
20 X 28	1.3	1.1	0.8	0.7	1.4	1.4	0.9	0.9
-28	0.5	0.2	0.3	0.3	0.3	1.3	0.9	0.9
Elemental Analysis, Wt %								
SiO_2	1.49	3.61		4.23		6.77		6.01
SO_3	1.60	0.73		0.67		0.63		0.77
Na_2O	0.08	0.11		0.11		0.08		0.04
CaO	53.11	54.74		55.88		66.85		70.13
MgO	40.07	37.92		35.15		22.00		19.45
K_2O	0.03	0.02		0.02		0.02		0.03
Al_2O_3	1.15	1.39		1.36		2.24		2.12
Fe_2O_3	1.84	1.96		1.90		1.81		1.43

Table 37-17. ACCEPTOR WITHDRAWAL FOR RUN 37A

Date	6/9/76		← 6/10/76 →			← 6/11/76 →		
Time	1430	2215	0600	1320	1840	0115	0820	1400
Screen Size, Wt %								
Tyler Mesh								
+9	0.1	0.1	Tr	0	Tr	1.0	4.5	4.4
9 X 12	39.8	41.4	38.8	56.9	35.6	40.2	45.5	48.5
12 X 14	32.4	32.2	30.3	8.6	33.6	32.3	28.9	27.0
14 X 20	26.3	24.8	28.9	32.9	29.2	24.2	19.2	17.5
20 X 28	1.1	1.1	1.5	1.1	1.1	1.4	1.1	1.2
-28	0.5	0.4	0.6	0.5	0.6	0.8	1.0	1.5
% Calcine Weight Change							-0.3	
Elemental Analysis, Wt %								
SiO_2							3.85	
SO_3							0.15	
Na_2O							0.05	
CaO							56.91	
MgO							34.89	
K_2O							0.02	
P_2O_5							0.02	
Al_2O_3							1.75	
Fe_2O_3							1.56	
TiO_2							0.10	

Table 37-18. ACCEPTOR WITHDRAWAL FOR RUN 37B (Sheet 1 of 2)

Date	← 6/12/76 →				← 6/13/76 →				6/14/76	
Time	0140	0905	1340	2200	0400	0625	1100	1625	0210	1100
Screen Size, Wt %										
Tyler Mesh										
+9	9.8	9.1	12.6	34.8	27.3	30.6	24.4	25.2	51.8	41.1
9 X 12	50.5	41.6	41.2	34.5	45.0	44.2	42.6	44.5	31.1	34.3
12 X 14	22.5	24.2	22.6	13.1	13.2	12.2	14.9	13.8	6.8	8.9
14 X 20	14.4	18.9	17.0	11.5	9.5	8.9	11.5	9.7	6.2	8.8
20 X 28	1.6	3.3	3.8	3.1	3.0	2.6	3.4	3.5	2.6	3.0
-28	1.3	2.9	2.8	3.1	2.1	1.4	3.2	3.4	1.5	3.1
% Calcine Weight Change		-0.2					-0.4		-2.0	
Elemental Analysis, Wt %										
SiO_2		5.52					7.67		8.49	
SO_3		0.30					0.47		0.89	
Na_2O		0.04					0.05		0.05	
CaO		67.52					78.87		76.18	
MgO		21.77					10.72		7.86	
K_2O		0.01					0.02		0.03	
Al_2O_3		1.69					2.39		4.44	
Fe_2O_3		1.60					1.72		1.55	
P_2O_5		0.04					0.06		0.05	
TiO_2		0.14					0.20		0.17	

Table 37-18. ACCEPTOR WITHDRAWAL FOR RUN 37B (Sheet 2 of 2)

Date	5/25/76		← 5/26/76 →		
Time	1945	1945	0100	0500	0830
Hopper	A	B	B	B	B
Screen Size, Wt % Tyler Mesh					
+35	1.5	2.8	7.6	5.0	2.6
35 X 48	4.7	4.9	6.3	6.9	5.7
48 X 65	10.4	10.8	13.1	14.4	12.6
65 X 100	0.5	0.4	6.2	3.2	0.4
100 X 200	33.0	37.2	24.7	24.8	28.2
200 X 325	21.1	15.9	20.5	25.0	25.5
-325	28.8	28.1	21.7	20.8	25.1
Ultimate Analysis, Wt %					
C	11.9	16.1	17.5	24.6	14.8
H	0.4	0.3	0.3	0.3	0.3
N		0.06		0.09	
Sulfide		1.00		0.78	
Total S	0.96	1.00	1.45	1.35	1.45
Ash + SO_3	89.2	87.2	83.9	79.8	86.6
Elemental Analysis, Wt %					
SiO_2	35.57	33.17	40.18	40.08	37.87
SO_3	6.10	6.48	5.79	6.35	6.35
Na_2O	1.82	2.12	0.74	0.41	0.55
CaO	42.01	42.38	37.57	39.99	41.68
MgO	3.29	3.87	4.94	3.41	3.29
K_2O	0.28	0.28	0.22	0.10	0.19
P_2O_5		0.08		0.09	
Al_2O_3	6.48	8.58	6.64	5.83	5.95
Fe_2O_3	2.54	2.73	3.16	3.14	3.65
TiO_2		0.28		0.28	
% Calcine Weight Change	-10.8	-12.8	-16.8	-20.2	-13.4

Table 37-19. ASH AND ATTRITED ACCEPTOR COMPOSITES FOR RUN 37A

Date	6/11/76		6/12/76	6/13/76		6/14/76	
Hopper	A	B	B	A	B	A	B
Screen Size, Wt %							
Tyler Mesh							
+35	4.8	5.4	4.8	0.5	6.2	60.6	3.9
35 X 48	4.7	6.0	5.7	1.4	6.6	0.6	5.1
48 X 65	10.1	10.8	10.5	2.6	11.3	0.7	10.3
65 X 100	7.4	8.5	13.7	3.9	16.1	0.8	15.2
100 X 200	22.3	24.7	21.8	6.1	22.2	1.8	22.5
200 X 325	14.5	13.8	13.8	3.8	12.7	2.4	13.6
-325	36.2	30.8	29.7	81.7	24.9	33.2	29.5
Ultimate Analysis, Wt %							
C	11.30	13.32	10.97	13.49	12.69	11.12	13.00
H	0.41	0.71	0.42	0.18	0.31	0.21	0.33
N	0.09	0.03	0.05	0.06	0.06	0.02	0.05
Sulfide	0.80	0.74	0.71	0.78	0.79	0.65	0.84
Total S	1.81	2.00	1.32	1.51	1.86	1.13	1.12
Ash + SO_3	88.12	86.88	89.84	87.21	87.70	85.18	86.70
Elemental Analysis, Wt %							
SiO_2	32.98	35.01	30.48	34.41	35.50	30.15	32.30
SO_3	4.85	5.83	4.03	5.95	5.42	3.05	3.58
Na_2O	0.62	0.74	0.36	0.62	0.35	0.21	0.27
CaO	41.25	41.75	47.96	40.97	43.41	52.81	47.53
MgO	8.09	4.92	6.50	3.17	3.88	3.23	3.66
K_2O	0.15	0.18	0.10	0.36	0.10	0.11	0.08
P_2O_5	0.06	0.10	0.11	0.10	0.12	0.10	0.12
Al_2O_3	6.97	7.26	7.28	9.99	6.98	7.30	7.20
Fe_2O_3	4.19	3.42	3.36	3.44	3.72	2.79	3.38
TiO_2	0.32	0.31	0.30	0.42	0.41	0.31	0.32

Table 37-20. ASH AND ATTRITED ACCEPTOR COMPOSITES FOR RUN 37B

Date				5/24/76	← 5/25/76 →			5/26/76
Time				1850	0312	1130	1900	0300
dPR-*	Chart	Zero	Range In. W.C.			Chart Readings		
2030	-10/10	9.0	554.0					
2089	0/100	4.2	25	9	27	35	19	7
2088	0/100	3.0	168.7	34	31	33	33	32
2087	0/100	3.0	43.7	65	58	64	66	67
2094	0/100	3.0	53.9	77	62	67	70	70
2093	0/100	3.0	115.4	40	34	36	36	36
2001	0/100	3.0	126.2	22	19	21	22	22
2002	0/100	3.0	57.1	45	45	43	43	40
2083	0/100	3.0	57.7	68	65	63	59	53
2019	0/100	4.2	300.0	42	46	37	33	24
2037	-10/10	9.0	40.0	0	-5.5	-8	-5.8	-5
2021	0/100	4.2	50.0	74	80	85	85	90
2022	0/100	4.8	25.0	48	50	51	58	58
2073	0/100	3.0	150.0	45	44	42	39	36
2074	0/100	3.0	180.0	75	70	70	63	57
2075	0/100	3.0	180.0	72	66	65	61	55
2076	0/100	3.0	144.0	52	48	45	45	41
2077	0/100	3.0	144.0	17	14	15	15	14
2024	0/100	4.2	98.6	39	42	42	40	40
2025	0/100	4.2	300.0	29	27	27	28	28
2026	-10/10	9.0	40.0	-2.2	-2.3	-2.3	-2.3	-2.4
2102	0/100	4.2	100.0	70	61	45	45	48
2020	0/100	4.2	300.0	65	68	70	67	70
2036	-10/10	9.0	20.0	-0.2	-1.0	-2	-2	-6
2028	0/100	4.8	50.0	35	50	65	60	65
2080	-2/2	9.0	40.0	62	65	70	72	73
Location*						Pressure, In. W.C.**		
1				0.0	0.0	0.0	0.0	0.0
2				59.62	58.55	65.73	60.14	54.86
3				179.17	161.45	176.65	173.10	171.78
4				274.35	252.61	268.12	263.04	258.97
5				373.95	366.46	353.97	336.06	305.43
6				373.95	355.03	337.33	324.05	294.76
7				322.63	301.36	281.12	265.88	236.27
8				255.27	236.71	219.41	208.19	184.69
9				-84.81	-80.70	-82.99	-82.13	-81.05
10				-110.47	-102.24	-105.33	-105.03	-102.75
11				4.42	4.58	4.72	4.60	4.75
12				125.29	114.30	106.06	100.67	96.83
13				282.80	277.53	274.91	261.74	260.96
14				281.83	272.73	265.31	252.09	232.96
15				259.84	242.60	227.39	216.96	194.17

*Refer to Figure 1.
**Static pressure at Location 1 is 150 psig.
Pressures given are differential pressures from Location 1.

Table 37-21. PRESSURE BALANCE DATA FOR RUN 37A

Date				6/12/76	← 6/13/76 →			← 6/14/76 →		
Time				1930	0300	1055	1905	0300	1713	1920
			Range				Chart Readings			
dPR-*	Chart	Zero	In. W.C.							
2030	-10/10	9.0	554.0	1.5	1.5	2.0	2.0	1.0	1.2	1.0
2089	0/100	4.2	25	65	2	13	13	14	12	3
2088	0/100	3.0	168.7	42	32	33	34	39	39	35
2087	0/100	3.0	43.7	83	82	73	72	82	85	83
2094	0/100	3.0	53.9	79	76	67	67	76	79	77
2093	0/100	3.0	115.4	42	40	36	36	40	42	41
2001	0/100	3.0	126.2	28	25	23	22	25	27	26
2002	0/100	3.0	57.1	32	31	31	27	21	24	24
2083	0/100	3.0	57.7	48	45	42	39	36	37	39
2019	0/100	4.2	300.0	17	35	27	12	21	22	28
2037	-10/10	9.0	100.0	-6.3	-6.0	-7.5	-6.4	-6.2	-6.5	-6.5
2021	0/100	4.2	50.0	75	78	75	85	78	80	80
2022	0/100	4.8	25.0	44	43	44	55	45	42	42
2073	0/100	3.0	150.0	32	30	29	27	26	27	27
2074	0/100	3.0	180.0	50	44	40	43	37	40	40
2075	0/100	3.0	180.0	50	54	46	41	44	47	47
2076	0/100	3.0	144.0	33	39	33	22	31	33	34
2077	0/100	3.0	144.0	12	34	16	2	13	19	24
2024	0/100	4.2	98.6	24	24	27	28	21	20	19
2025	0/100	4.2	300.0	15	13	18	22	13	13	12
2026	-10/10	9.0	40.0	-1.2	-1.1	-1.1	-1.1	-1.4	-1.6	-1.5
2102	0/100	4.2	100.0	9	45	34	45	44	42	41
2020	0/100	4.2	300.0	70	73	60	42	58	65	65
2036	-10/10	9.0	20.0	-0.2	-1.6	-0.4	0.0	0.0	-0.4	-0.6
2028	0/100	4.8	50.0	75	65	62	70	67	70	55
2080	-2/2	9.0	40.0	73	70	70	70	71	71	68
							Pressure, In. W.C.**			
	Location*									
	1			0	0	0	0	0	0	0
	2			85.65	53.06	55.72	59.79	64.97	65.34	57.29
	3			221.30	182.69	173.15	179.26	197.85	204.64	191.31
	4			307.79	261.90	249.08	251.09	267.36	279.74	265.23
	5			331.63	341.94	304.88	259.26	304.38	320.22	324.25
	6			298.34	310.57	265.06	224.55	271.16	285.18	289.72
	7			249.55	259.99	216.61	170.30	221.59	235.68	239.39
	8			203.07	215.82	174.62	132.08	184.21	197.17	200.23
	9			-29.94	-24.04	-40.26	-54.80	-19.92	-18.90	-15.48
	10			-48.80	-75.37	-65.84	-59.04	-41.14	-48.91	-52.70
	11			2.37	2.15	2.09	2.18	2.64	3.05	2.89
	12			91.26	93.13	84.76	98.21	103.02	101.28	92.88
	13			257.18	269.59	221.66	182.43	232.92	249.65	243.72
	14			256.24	261.96	219.79	182.43	232.92	247.81	240.91
	15			212.46	223.84	182.77	140.41	192.86	205.88	207.54

*Refer to Figure 1.
**Static pressure at Location 1 is 150 psig.
Pressures given are differential pressures from Location 1.

Table 37-22. PRESSURE BALANCE DATA FOR RUN 37B

Elemental Analysis, Wt %	"Glass"	"Glue"
SiO_2	44.07	42.92
SO_3	0.35	0.24
Na_2O	0.93	0.58
CaO	23.75	32.44
MgO	5.80	6.38
K_2O	0.21	0.16
Al_2O_3	17.10	12.43
Fe_2O_3	5.29	4.23
P_2O_5	0.82	0.42
TiO_2	0.67	0.40

Table 37-23. ANALYSES OF GLASSY MATERIAL FROM ROSEBUD FEED AND GLUE MATERIAL FROM CIRCULATING ACCEPTOR FOR RUN 37B

RUN 38

RUN 38A JULY 2 TO JULY 10, 1976

RUN 38B JULY 20 TO JULY 27, 1976

RUN 38C JULY 31 TO AUGUST 30, 1976

CO_2 ACCEPTOR PROCESS GASIFICATION

PILOT PLANT

RAPID CITY, SOUTH DAKOTA

1 SUMMARY

Run 38 was conducted in three parts and was the first time that Wyodak subbituminous coal was used as a feedstock in integrated plant operation. Locally quarried Minnekahta limestone was used as the acceptor feedstock. The objectives of the run were: demonstration of the technical feasibility of the CO_2 Acceptor Process using an untreated subbituminous coal feedstock; operation of the methanation unit; operation of the Elliott test stand; and a planned and voluntary shutdown.

The initial run in the series, Run 38A (July 2-July 10, 1976), ended prematurely when capacity of the flow control valve in the lower acceptor standleg was exceeded. This happened when the circulation rate was increased in order to increase the char bed temperature from 1520^{o} to 1530^{o}F.

The run was not of sufficient length to produce steady-state data for heat and material balance calculations. However, the startup was smooth and progressed past the point at which all of the air was removed as a gasifier heat source. Approximately 88 percent of the original dead-burned dolomite had been removed and replaced with fresh limestone prior to shutdown.

Run 38B (July 20-July 27, 1976) also ended prematurely when several large pieces of agglomerated acceptor lodged on the flow control valve in the lower acceptor standleg. The agglomerates immediately stopped transfer from the boot. This run did not proceed much past the point of Run 38A before shutdown.

Run 38C (July 31-August 30, 1976) was the most successful of the three runs but did not accomplish the desired objectives. Run 38C required five startup attempts to get the plant operating and then two periods of putting the plant into a hold condition due to problems in the coal grinding system. The interface had to be blown away once due to loss of transfer through the recarbonated acceptor standleg. Problems were also encountered due to low acceptor particle density during the run which resulted in a high gasifier bed density.

In order to salvage some useful information from this problem-plagued run, a balance period of more than a day was made using air as a heat source in the gasifier.

2 TEST DATA

Run 38A, 38B, 38C data are presented graphically and/or tabularly at the end of this report. These figures and tables include:

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During Aged Acceptor Circulation Tests

3 SIGNIFICANT EVENTS AND OBSERVATIONS

3.1 TABULAR HISTORY OF RUNS 38A, 38B AND 38C

3.1.1 Objectives

The goals for all three parts of Run 38 were:

(1) To demonstrate the technical feasibility of the process using a subbituminous coal feedstock.

(2) Integrated plant operation followed by a planned voluntary shutdown.

(3) Operation of the methanation unit.

(4) Operation of the Elliott test stand.

3.1.2 Accomplishments

Run 38A and Run 38B

The plant operated in an integrated manner of sufficient length to allow a substantial change-out of dead-burned dolomite with fresh limestone and the removal of all air supplied to the gasifier.

Run 38C

(1) The main accomplishment was a planned and voluntary shutdown.

(2) A stable balance period for which heat and material balances can be caluclated was obtained.

(3) Directly measured the circulation rate of aged acceptor in the pilot plant.

3.1.3 Termination Causes

Run 38A

This run ended when the capacity of the recarbonated acceptor flow control valve was exceeded. This occurred when the acceptor circulation rate was increased in order to raise the gasifier char bed temperature from 1520°F to 1530°F. Since

the valve could not keep up with the circulation rate, the char-acceptor interface rapidly rose into the transition section where the acceptor defluidized and agglomerated. Steps were taken to refluidize the char-acceptor mixture but acceptor transfer could not be regained.

Run 38B

This run ended when several large pieces of agglomerated acceptor lodged on the recarbonated acceptor control valve and immediately stopped acceptor transfer. The char-acceptor interface was blown away before it could rise into the transition section, but the line could not be cleared and the run was terminated.

Run 38C

After a two and one-half day balance period, the plant was voluntarily shut down. This was done in order to make a run using the remainder of the Glenharold lignite so that space would be available to store the incoming shipment of Texas lignite.

3.1.4 Mechanical Problems

Run 38A

The upset which terminated the run was caused by a slight bottleneck in the process at the recarbonated acceptor flow control valve. This valve was enlarged from four to five inches prior to Run 38B.

Run 38B

During the initial filling of the gasifier char bed, the char-acceptor interface could not be established. This was due to the use of a coarse char grind. The contents of the gasifier were dumped and the gasifier refilled with dead-burned dolomite from the regenerator and the run then proceeded smoothly until the end.

Run 38C

(1) A leak in the water jacket on the regenerator overhead line required the plant to be shut down for repairs.

(2) A hot spot occurred on the recarbonated acceptor stand-leg requiring the plant to shut down for inspection.

(3) Large pieces of the regenerator refractory spalled causing the bottom of the regenerator to plug. This required the plant to be brought down for cleaning.

(4) The line between the regenerator and the spent acceptor lockhopper plugged and could not be cleaned without depressuring the plant.

(5) The char transfer line at the regenerator plugged with slaked acceptor.

(6) The grinding area had to be shut down several times during the run so that repair could be made. Most of the problems were due to jamming of the baghouse carriage drive and to the development of a high differential pressure across the baghouse.

3.1.5 Process Problems

Run 38A

Run 38A was plagued by a high char bed density towards the end of the run. This required acceptor circulation to be cut back to keep the process in a stable operating condition. This also required air to be injected into the gasifier to supply the remaining heat duty. Steps were taken to lower the bed density. This was successful until the capacity of the flow control valve in the recarbonated acceptor standleg was exceeded. This resulted in the termination of the run.

Run 38B

No process related problems were encountered during this run.

Run 38C

(1) The char-acceptor interface was blown away when instrumentation indicated that there was a restriction at the recarbonated acceptor flow control valve. The valve indicator showed that the valve was wide open although the interface was rising into the transition section.

(2) There were also large pressure swings in the system that were created by malfunctions in the regenerator quench tower level controller.

(3) Due to a lower than expected acceptor particle density, the necessary acceptor circulation could not be achieved to allow removal of air from the gasifier during the run. The low particle density inhibited the acceptor showering through the char bed and resulted in high char bed densities due to stone holdup. Low acceptor particle density is apparently typical with a subbituminous coal feedstock.

3.2 CHRONOLOGY OF OPERATIONS

Run 38A

Date	Time	Hours Run	Description
7/2	0140		Started grinding test with Wyodak subbituminous coal.
"	1115		Pressuring up the unit with air.
"	1245		Depressuring the unit to repair some leaks.
"	1435		Pressuring up the unit with air.
"	1835		Finished the grinding tests in the 100 area.
"	2100		System up to pressure, starting the static pressure test.
"	2115		Finished the static pressure tests. Started all recycle gas compressors.
"	2200		Lit the pilots on all the process heaters.
7/3	1845		Began to slowly bring up the heater temperatures.
7/4	0320		Starting the temperature holding period for the refractory cure.
"	1600		Finished the refractory cure holding period and raising heater temperatures.
7/5	0020		Started grinding Wyodak coal to the preheater
"	0420		Started the second refractory cure holding period. Started the heater differential pressure tests.
"	0800		Finished the refractory cure holding period.
"	0920		Finished the heater differential pressure tests. Started feeding dead-burned dolomite to the gasifier via F-204A, fresh lignite feed lockhopper.
"	1055		Transferred a batch of dead-burned dolomite from the gasifier to the regenerator.
"	1210		Started feeding dead-burned dolomite to the regenerator from F-206, fresh acceptor feed lockhopper.
"	1810		Established acceptor circulation.
"	1940		Started the acceptor circulation tests.
"	1955		Finished the acceptor circulation tests.
"	2010		Started steam flow to the gasifier side.

Date	Time	Hours Run	Description
7/5	2153		Started feeding char to the gasifier via F-204A.
7/6	0110		Started air flow to the gasifier side.
"	0500		Stopped grinding coal due to a plugged roller mill.
"	0800		Resumed grinding coal.
"	0955		Started steam flow to the gasifier boot.
"	1545		Established char transfer.
"	1930	0	Regenerator at 1800°F.
"	2316		Started feeding Wyodak coal to the gasifier.
7/7	0130		Switched from char to coal grinding.
"	0500		Started feeding fresh 6 X 9 limestone to the regenerator via F-206. Added CO_2 gas to the gasifier boot flow.
"	0730	12	Started removing air from the gasifier side flow.
"	1415		Switched from FE-3000 to FE-3046 for calculating the gasifier vent flow.
"	2100		Started sending product gas to the front end of the methanation unit.
7/8	1040		Attempted to raise the gasifier boot flow but the increase in the bed density made it necessary to lower it again.
"	1915	47.75	Stopped grinding coal for maintenance work.
"	2300		Resumed coal grinding.
7/9	0645		Shut off the auxiliary char feed to the regenerator to maintain the bed level in the gasifier.
"	0840		Stopped grinding for maintenance work.
"	0910		Resumed feeding auxiliary char to the regenerator.
"	1105		The coal feed has been decreased several times in order to maintain the proper level of the gasifier bed.
"	1230	65	Resumed coal grinding.
"	2400		The Redler conveyor in the 100 area has sheared pins numerous times.
7/10	0900-1500		Attempting to lower the density of the gasifier by lowering boot flow and increasing the side flow.
"	1005		100 area grinding stopped due to the Redler conveyor breaking.
"	1440		Redler conveyor repaired and coal grinding resumed.
"	1510		All air out of the gasifier.
"	1530	92	Unable to transfer acceptor out of the gasifier boot, immediately initiated the normal procedures to prevent a deposit from forming.
"	1630		Initiated shutdown procedures for the entire plant.

Run 38B

Date	Time	Hours Run	Description
7/20	1600		Starting to pressure up the system with air.
"	1630		Holding system pressure to check for leaks.
"	1830		Continuing with pressuring up of the system.
"	2100		Holding system pressure to check for leaks again.
"	2345		Continuing with pressuring up of the system.
7/21	0015		System up to pressure, started the static pressure test.
"	0135		Finished the static pressure test.
"	0215		Initiated gas circulation.
"	0345		Lit all the heater pilots.
"	0830		Started the 250°F refractory cure holding period.
"	1330		Finished the refractory cure holding period and continuing with heatup.
"	2300		Starting the second refractory cure holding period.
7/22	0400		Finished with the refractory cure holding period and continuing with heatup.
"	1030		Started grinding Wyodak coal for the preheater.
"	1425		Started the third refractory cure holding period.
"	1730		Finished the refractory cure holding period and continuing with system heatup. Started the heater differential pressure tests. The Redler conveyor sheared a pin and stopped coal grinding.
"	1815		Redler conveyor repaired and resumed coal grinding.
"	2200		Finished the heater differential pressure tests.
"	2212		Started feeding dead-burned dolomite to the gasifier via F-204A, fresh lignite feed lockhopper.
7/23	0025		Started feeding dead-burned dolomite to the regenerator via F-206, fresh limestone lockhopper.
"	0810		Established acceptor circulation.
"	0830		Started the circulation tests. Blew out a rupture disc on the 100 area baghouse and burned up the dust bags. Rupture disc apparently had deteriorated with time.
"	1015		Finished the circulation tests.
"	1100		Initiated steam flow to the gasifier side.
"	1140		Started the B-207 differential pressure tests.
"	1230		Finished the B-207 differential pressure tests.
"	1315		Started feeding char to the gasifier via F-204A

Date	Time	Hours Run	Description
7/23			NOTE: Unable to establish a proper interface. Finally dumped the contents of the gasifier, refilled with dolomite from the regenerator and started feeding char again. Finally established the interface by cutting overhead circulation and dropping the gasifier boot flow for a short time.
"	2210		Increased the air to the gasifier side.
7/24	0230		The dust bags replaced in the 100 area and starting to grind char.
"	0257		Added steam to the gasifier boot flow.
"	0605		Started feeding auxiliary char to the regenerator.
"	0655		Auxiliary char shut off in order to establish char transfer.
"	0700		Unable to establish char transfer. NOTE: Char transfer established for a short time, finally blew the transfer line clear and raised the differential pressure between the vessels to establish transfer.
"	1020		Redler conveyor sheared a pin, stopping coal grinding.
"	1130		Stable char transfer established.
"	1200		Started auxiliary char feed to the regenerator.
"	1230	0	Regenerator at 1800°F.
"	1245		The Redler conveyor was repaired and coal grinding was resumed.
7/25	0043		Feeding Wyodak coal to the gasifier.
"	0630		Initiated CO_2 gas flow to the gasifier boot.
"	0730	19	Started feeding fresh 6 X 9 limestone to the regenerator.
"	0920		Started the procedure to remove air and recycle gas from the gasifier.
"	0945		Experienced some temperature problems in the regenerator. Part of the trouble was due to not knowing the percentage of carbon monoxide in the regenerator overhead gases. The gas analyzer shed had overheated and caused the analyzers to malfunction.
"	1915		The Redler conveyor sheared a pin again.
"	2020		Conveyor repaired and resumed coal grinding.
"	2400		Having to shut down the grinding area periodically to clean the dust bags due to high solids loading.
7/26	0500		Plugged the grinding mill and lift line in the 100 area and had to stop grinding.
"	1000	45.5	Recycle gas flow removed from the regenerator ring flow.

Date	Time	Hours Run	Description
7/26	1513		100 area repaired and resumed coal grinding.
"	1831		Air flow removed from the gasifier side flow, continuing with removal of recycle gas from the gasifier boot flow.
7/27	0200		All recycle gas out of the gasifier boot flow.
"	0515	64.75	Experienced trouble in the gasifier boot and unable to transfer acceptor to the regenerator.
"	0530		Stopped coal grinding.
"	0800		Initiated the shutdown procedure.
Run 38C			
7/31	1630		Started pressuring up the system with air.
"	1710		Holding system pressure while several leaks are repaired.
"	2000		A leak in the regenerator overhead line was found. The unit was depressured in order to repair it.
8/1	1610		Pressuring up the system with air.
"	1725		Started the static pressure test.
"	1830		Finished the static pressure test.
"	1835		Started gas circulation.
"	1900		Lit the process heaters.
"	2230		Started the 250°F refractory cure holding period.
8/2	0230		Finished the refractory cure holding period and raised system temperatures.
"	1200		Starting the 700°F refractory cure holding period.
"	1240		The temperature paint on LCV-2003, spent acceptor control valve, turned white very quickly. Initiated shutdown procedures to find out the reason.
"	1820		Repressuring the system. NOTE: Evidently some char in the spool piece burned causing the hot spot, the refractory lining of the spool piece was in good condition.
"	1915		System up to pressure, initiated gas circulation and lit the process heaters.
8/3	0045		Started the heater differential pressure tests.
"	0305		Finished the heater differential pressure test.
"	1118		Started adding dead-burned dolomite to the gasifier via F-204A, fresh lignite feed lockhopper.
"	1245		Started grinding Wyodak coal for the preheater.
"	1352		Started feeding dead-burned dolomite to the regenerator via F-206, fresh acceptor feed lockhopper.
"	1410		L-204, fresh acceptor feeder, sheared a pin stopping dead-burned dolomite feed.
"	1430		L-204 repaired, resumed feeding dolomite.

Date	Time	Hours Run	Description
8/3	2115		Started circulating dead-burned dolomite.
"	2200		Experienced a power dip, recovered without problems.
"	2300		Attempting to run the acceptor circulation test without success.
8/4	0055		The acceptor lift gas suddenly started flowing through LCV-2003 slumping the regenerator bed. Attempts to pick up the bed failed. Initiated shutdown procedures.
"	0230		Stopped grinding coal for the preheater.
"	0400		Cooling down the 100 area for maintenance work on the baghouse.
"	0700		System depressured.
"	1315		Pressuring up the system in order to circulate gas and cool the system down.
8/5	0545		System depressured.
8/6	1800		Pressuring up the system with air.
			NOTE: Shutdown inspection revealed a large piece of refractory in the bottom of the regenerator which diverted the lift gas and slumped the bed.
"	1930		Started the static pressure test.
"	2000		Static pressure test finished.
"	2130		Started gas circulation and lit the process heaters.
8/7	0100		Started the 250°F refractory cure holding period.
"	0800		Finished the refractory cure holding period and started raising system temperatures.
"	1245		Depressuring system due to a plugged line to F-228, spent acceptor lockhopper.
"	1930		Cleared the line to F-228 and pressuring up the system.
"	2025		Started gas circulation and lit the process heaters.
8/8	0900		Started the 700°F refractory cure holding period.
"	1130		Started the heater differential pressure tests.
"	1330		Finished the heater differential pressure test.
"	1845		Started feeding dead-burned dolomite to the gasifier via F-204A.
"	1930		Lost dead-burned dolomite feed due to a sheared pin on the L-207A feeder.
"	2014		L-207A feeder repaired and started feeding dead-burned dolomite again.
"	2224		Started feeding dead-burned dolomite to the regenerator via F-206.
8/9	0615		Initiated dead-burned dolomite circulation.
"	0800		Started the circulation tests.
"	0845		Finished the circulation tests.
"	0855		Started steam to the gasifier side flow.
"	0935		Started feeding char to the gasifier via F-204B.
"	1200		Initiated air flow to the gasifier side flow.

Date	Time	Hours Run	Description
8/9	1500-2000		The char transfer line, CO-202, would not fill and seal. Finally, determined that the vertical char transfer line, CO-204, was plugged.
"	2025		Initiated shutdown procedures.
8/10	0400		System depressured.
8/11	1400		Started pressuring up the system with air.
"	1600		Started the static pressure test.
"	1630		Finished the static pressure test.
"	2100		Initiated gas circulation.
"	2300		Lit the process heaters.
8/12	0400		Started the heater differential pressure tests.
"	0540		Finished the heater differential pressure tests.
"	1815		Started feeding dead-burned dolomite to the gasifier via F-204A.
"	2300		Started feeding dead-burned dolomite to the regenerator via F-206.
8/13	0748		Initiated solids circulation.
"	0830		Started the circulation tests.
"	1035		Finished the circulation tests.
"	1055		Initiated steam to the gasifier side flow.
"	1140		Started feeding char to the gasifier via F-204A.
"	1435		Initiated air to the gasifier side flow.
"	1730		Started grinding Wyodak coal for the preheater.
"	2000		Started feeding auxiliary char to the regenerator.
"	2200		Started char transfer.
"	2320		System pressure swinging badly, looking for the problem.
"	2350	0	Regenerator at 1800°F.
8/14	0545		System pressure swings damping out.
"	1500		Found that the system pressure problem was in the gasifier cyclone and venturi system. Correcting the problem and the plant is smoothing out.
"	2235	22.75	Started feeding Wyodak coal to the system.
8/15	1145		Started the procedure to remove air and recycle gas from the gasifier.
"	1325-1430		Again had problems with the gasifier cyclone and experienced some system pressure swings.
"	1730		Finished grinding Wyodak coal for the preheater.
"	2400	48.1	Experienced problems dumping the contents of F-207B, regenerator ash out lockhopper.
8/16	0745		Grinding Wyodak coal for the preheater.
"	2400	72.1	NOTE: System pressure upset several times during the periods of emptying the gasifier cyclone. Experiencing high baghouse differential pressure in the 100 area.

Date	Time	Hours Run	Description
8/17	0415		Finished grinding Wyodak coal and shut down the unit for maintenance work.
"	2400	96.1	No major problems in the 200 area.
8/18	0250		Started up the 100 area but the baghouse carriage was not working properly. Shut down for maintenance.
"	0320	99.4	Due to the trouble in the 100 area, initiated coal saving procedures in the 200 area.
"	0405		All air out of the gasifier.
"	0415		Stopped feeding Wyodak coal to the gasifier.
"	0550		Resumed feeding Wyodak coal to the gasifier.
"	0625		Initiated air to the gasifier side flow. Just holding bed levels and temperatures to conserve coal. Regenerator quench tower plugging off.
"	1015		Maintenance finished with the 100 area and resumed grinding coal.
"	2150		Shut down the 100 area again due to problems with the baghouse.
8/19	0010		Shut off the coal feed to the gasifier.
"	0400		Removed air from the gasifier side flow.
"	0500		Shut off auxiliary char feed to the regenerator.
"	0525		Maintenance finished with 100 area and grinding Wyodak coal.
"	1345		Shut down the 100 area for maintenance work.
"	1355		Started char feed to the gasifier.
"	1500		Resumed auxiliary char feed to the regenerator.
"	1620		Maintenance finished with the 100 area and started grinding Wyodak coal.
"	1855		Resumed char transfer.
"	1930		Lost char transfer.
"	2315		Char transfer restarted.
8/20	0517		Resumed feeding Wyodak coal to the system.
"	1600	0	Regenerator at 1800°F.
"	1733		Shut down the 100 area for maintenance due to baghouse carriage and blower malfunction.
"	2120		System pressure swinging. Found a restricted tap on PCV-2052, the gasifier recycle discharge.
8/21	0200		Maintenance finished with 100 area repair and resumed coal grinding.
"	0800		Problems in grinding area stopped coal grind due to baghouse problems.
"	0830	16.5	Placing the plant in a hold period until grinding area is straightened out.
"	1340		Stopped feeding coal to the system.
"	1407		Removed air from the gasifier side flow.
"	1445		Started auxiliary char feed to the regenerator.

Date	Time	Hours Run	Description
8/21	1510		Stopped solids circulation.
"	1730		Removed the steam from the gasifier and began emptying the contents.
"	1810		Resumed grinding coal after receiving the 100 area back from maintenance.
"	2020		Resumed solids circulation.
8/22	0030		Started special solids circulation tests using aged acceptor.
"	0300		Finished the solids circulation tests.
"	0320		Initiated steam to the gasifier side flow.
"	0356		Started feeding char to the gasifier via F-204A.
"	0400		Stopped grinding and turned the 100 area over to maintenance.
"	0730		Introduced air flow to the gasifier side.
"	1020		Started steam flow to the gasifier boot.
"	1315		Began feeding auxiliary char to the regenerator.
"	1320		Initiated char transfer.
"	1325		Backing off on plant program and returning to a hold position until the mill is repaired.
"	1800		Maintenance repaired the 100 area and resumed coal grinding.
"	2100	0	Regenerator at 1800^{o}F.
"	2318		Resumed plant program and started feeding Wyodak coal to the system.
8/23	1225	15.5	Started the air removal from the gasifier procedure.
"	1830		Lost char transfer to the regenerator.
"	1955		Recovered char transfer.
8/24			Shut down the 100 area for maintenance work on the mill feeder.
"	0830		Maintenance repaired the 100 area and resumed
"	0910		Plugged the exit of the regenerator cyclone, L-202B.
"	0945		Cleared the plug on L-202B and shook the system slightly.
"	1030	37.5	Holding the steam/recycle flows to the gasifier boot at a 75/25 ratio.
8/25	0100		Stopped grinding in order to repair the lignite conveyor.
"	0115		Resumed coal grinding.
"	0800		Experiencing problems in the gasifier boot. Adjusted the boot flows and the boot straightened out.
"	1730		The density of the gasifier bed increasing.
"	2145	72.7	Adjusted gasifier flows and the bed density decreased.

Date	Time	Hours Run	Description
8/26	2400	99	Plant operation very smooth all day.
8/27	0610		Stopped coal grinding for routine maintenance work.
"	0850	107.8	Initiated the voluntary shutdown procedure. Began reducing the limestone and Wyodak coal feed.
"	0935		All air out of the gasifier side flow.
"	0950		Removed the auxiliary char feed from the system.
"	1100		Stopped char transfer.
"	1102		Stopped overhead solids circulation.
"	1125		Began dumping the contents of the gasifier to F-213, gasifier dump lockhopper.
"	1330		Began test grinding Wyodak coal in the 100 area.
"	1418		Shut down the process heaters.
"	1600		Transferred as much stone as possible from the regenerator to the gasifier and then emptied it to F-213.
8/28	0100		Finished with the test grind, shut down the 100 area.
"	0530		Main unit depressured.
"	0940		Repressuring the plant to cool down the reactors, system empty of limestone.
"	1230		Initiated the heater differential pressure tests.
"	1600		Finished the heater differential pressure tests.
8/30	0700		System depressured.

4 RESULTS AND DISCUSSIONS

4.1 BACKGROUND

Run 38 was the first integrated plant operation using a Wyoming subbituminous coal (Wyodak) feedstock. Data from Run 31 indicated that pretreatment of subbituminous coals was unnecessary and that no particle swelling would occur. Therefore, the Wyodak coal feedstock for Run 38 was not preoxidized.

4.2 ACCOMPLISHMENTS

4.2.1 Major Operational Achievements

The plant operations for Runs 38A, 38B and 38C are summarized below:

Run	Process Conditions	Subbituminous Feed	Acceptor Circulation	Fresh Acceptor Makeup	Without Gasifier Air	100% Steam to Boot
38A	92	88	118	83	0.5	0
38B	65	53	93	46	11	3
38C	219	209	407	289	0	0

During Run 38C the decision was made to obtain a balance period with some air remaining in the gasifier as a heat source. This was due to an insufficient acceptor circulation rate which was caused by a low acceptor particle density. A stable period of more than a day was obtained. The plant was then voluntarily shut down to allow inspection of the reactors and equipment. Both reactors were essentially clean. Run 38A and 38B were not of long enough duration to allow change out of the acceptor inventory and to obtain a balance period.

4.2.2 Plant Data

The data for all three runs is presented in Tables 38-1 through 38-33. The balance period for Run 38C was from 0300 hours on the 26th until 0700 hours on the 27th of August 1976.

4.2.3 Acceptor Circulation

Run 38C offered the opportunity to measure the circulation rate of aged acceptor. The usual procedure is to measure the circulation rate on startup using dead-burned dolomite (refer to Run 17 and Run 22C reports). Figures 38-2 and 38-3 are a comparison of the acceptor

circulation data from Run 22C and Run 38C. Figure 38-2 is a comparison of acceptor circulation rate at constant lift gas velocity versus lift line pressure drop. Figure 38-3 is a comparison of lift line pressure drop versus lift gas velocity with circulation rate as a parameter. Figure 38-2 shows a lower circulation rate at constant pressure drop and lift gas velocity in Run 38C. This is probably due to a 53 percent lower particle density and a larger mean particle diameter. Figure 38-3 should support this hypothesis but the data is insufficient.

4.3 PROBLEMS

4.3.1 Intermediate Fines

During the second holding period of Run 38C, the gasifier was completely drained and refilled. This was done to purge the system of the high level of intermediate fines which had accumulated in the gasifier char bed. The accumulation was apparently due to the use of large amounts of Husky char as auxiliary fuel for several days. Inspection of the as-received Husky char revealed that it contained large amounts of clay. This was circulated to the gasifier with the acceptor and was trapped there. At times during Run 38C intermediate fines represented up to 17 weight percent of the gasifier char bed. Adding to the problem of the intermediate fines was the low particle density of the limestone acceptor.

5 FUTURE PLANS

Plans for the next run will be the use of Glenharold lignite as the coal feedstock. The steam partial pressure will be reduced to try to eliminate the agglomerated acceptor deposits that formed in the gasifier boot during Run 38. These deposits occur with use of moderately high sodium content lignites in the presence of at least 10 to 11 atmospheres of steam partial pressure. The acceptor becomes "sticky" due to Na_2O transfer from the coal ash to the acceptor. The acceptor then agglomerates if it is allowed to stagnate, even for a very short time.

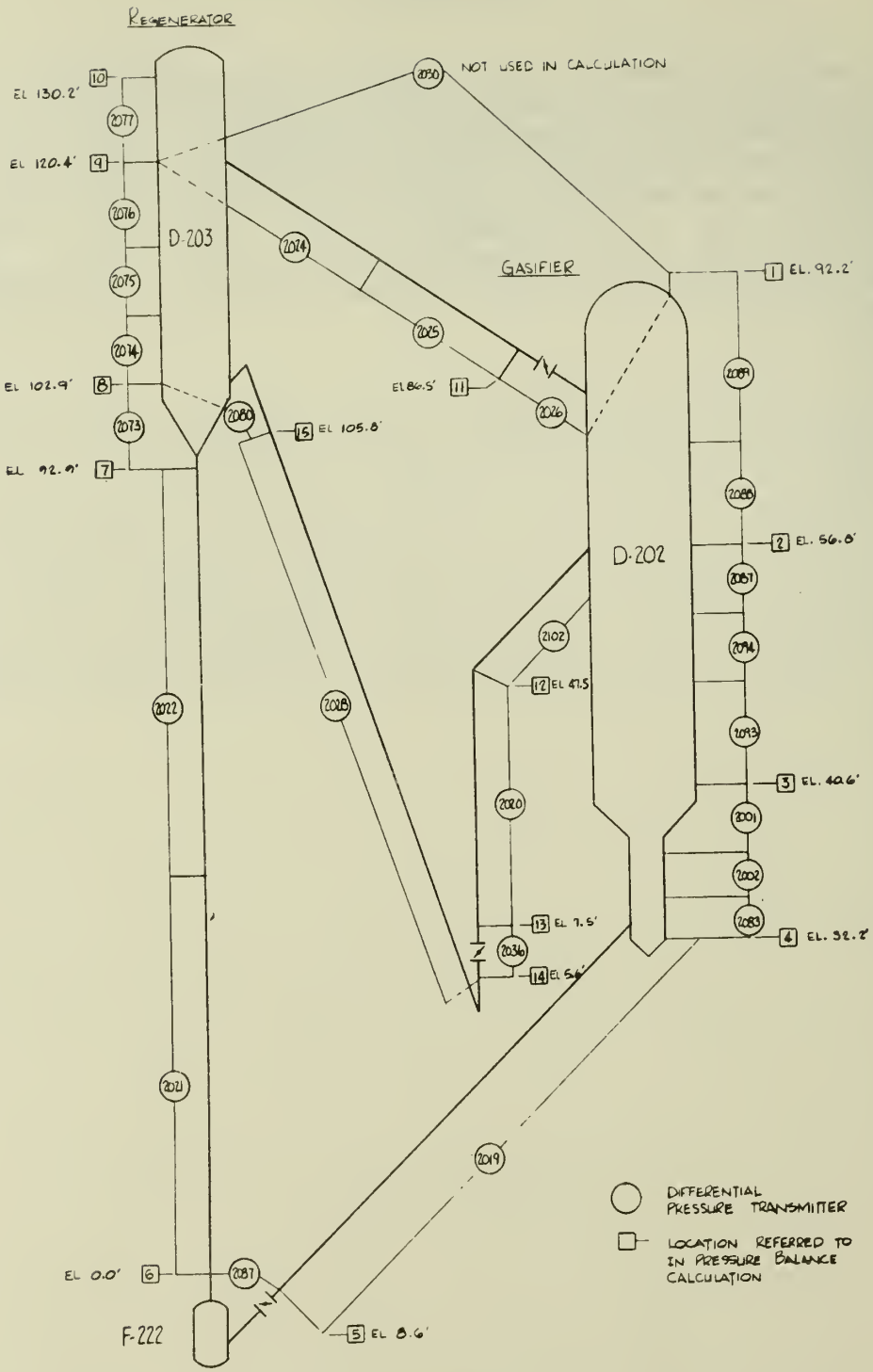

Figure 38-1. DIFFERENTIAL PRESSURE TRANSMITTER LOCATION PRESSURE BALANCE CALCULATION

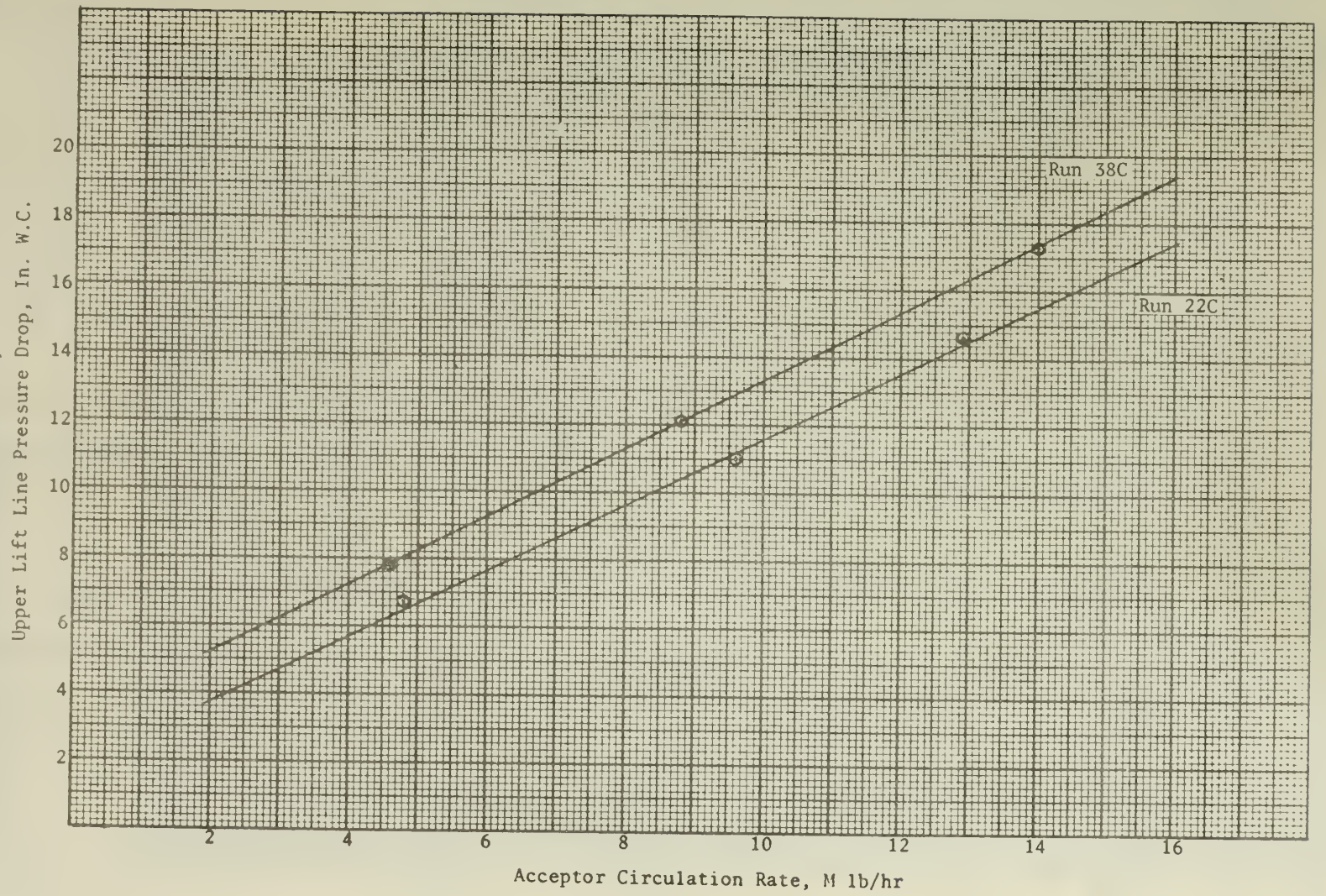

Figure 38-2. ACCEPTOR CIRCULATION RATE VS UPPER LIFT LINE PRESSURE DROP

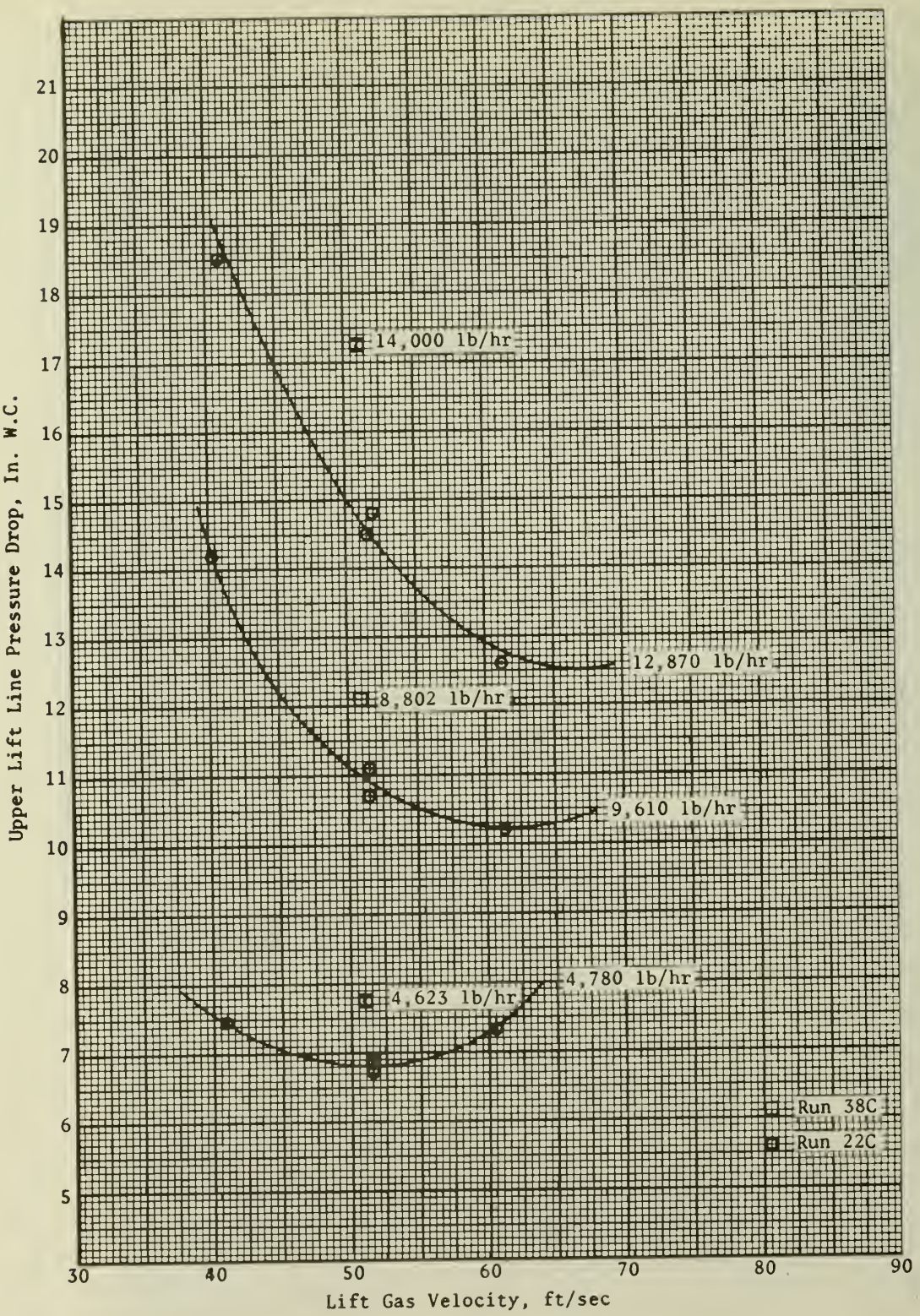

Figure 38-3. LIFT LINE PRESSURE DROP AS A FUNCTION OF LIFT GAS RATE AND SOLIDS CIRCULATION

Date 7/2/76 - 7/10/76

Screen Size, Wt % Tyler Mesh	Acceptor: Dead-Burned Dolomite	Acceptor: Minnekahta Limestone	Screen Size, Wt % Tyler Mesh	Coal: Husky Char	Coal: Wyodak Subbituminous
+4	↓	↓	+6	↓	↓
4 X 6	55.2	48.2	6 X 8		
6 X 8	↓	↓	8 X 10		
8 X 9	31.5	39.8	10 X 14		
9 X 10	↓	↓	14 X 20	32.2	20.8
10 X 12	12.9	10.8	20 X 28	↓	↓
12 X 14	↓	↓	28 X 35	49.8	55.2
14 X 16	0.2	0.2	35 X 48	↓	↓
16 X 20	↓	↓	48 X 65	14.1	17.9
20 X 24	Tr	0.1	65 X 100	↓	↓
24 X 28	0.2	0.9	100 X 200	3.9	6.1
-28			200 X 325		
			-325		
Particle Density, lb/cu ft	205	160			
Ultimate Analysis, Wt %					
Moisture				4.16	4.25
C				70.32	67.24
H				2.87	4.54
N				0.79	0.83
S				0.97	0.68
Ash + SO_3				8.56	6.50
Elemental Analysis, Wt %					
SiO_2	1.38	3.97		40.90	38.59
SO_3	0.16	0.17		17.69	13.05
Na_2O	0.07	0.02		1.56	0.61
CaO	58.24	93.62		18.17	21.87
MgO	39.94	0.78		3.36	3.85
K_2O	0.01	0.01		0.21	0.21
P_2O_5	0.88	0.84		11.86	16.71
Al_2O_3	1.13	0.36		6.00	3.73
Fe_2O_3	0.01	0.03		0.11	0.45
TiO_2	0.04	0		0.46	0.68

Table 38-1. FEEDSTOCK COMPOSITES FOR RUN 38A

Date 7/20/76 - 7/27/76

Screen Size, Wt % Tyler Mesh	Acceptor: Dead-Burned Dolomite	Acceptor: Minnekahta Limestone	Screen Size, Wt % Tyler Mesh	Coal: Husky Char	Coal: Wyodak Subbituminous
+4	↓		+6	↓	↓
4 X 6			6 X 8		
6 X 8	55.2	47.8	8 X 10		
8 X 9	↓		10 X 14		
9 X 10	31.5	48.5	14 X 20	32.2	17.2
10 X 12	↓		20 X 28	↓	↓
12 X 14	12.9	3.3	28 X 35		
14 X 16	↓		35 X 48	49.8	56.7
16 X 20	0.2	0.1	48 X 65	↓	↓
20 X 24	↓		65 X 100	14.1	21.9
24 X 28	Tr	Tr	100 X 200	↓	↓
-28	0.2	0.3	200 X 325		
			-325	3.9	4.2
Particle Density, lb/cu ft	205	160			
Ultimate Analysis, Wt %					
Moisture				4.16	Tr
C				70.32	68.0
H				2.87	4.8
N				0.79	0.5
S				0.97	0.68
Ash + SO_3				8.56	6.33
Elemental Analysis, Wt %					
SiO_2	1.38	4.36		40.90	38.51
SO_3	0.16	0.08		17.69	10.41
Na_2O	0.07	0.01		1.56	0.64
CaO	58.24	92.31		18.17	23.54
MgO	39.94	1.10		3.36	5.18
K_2O	0.01	0.05		0.21	0.28
P_2O_5	0.88	1.44		11.86	15.00
Al_2O_3	1.13	0.41		6.00	4.32
Fe_2O_3	0.01	0.04		0.11	0.52
TiO_2	0.04	0.06		0.46	0.80

Table 38-2. FEEDSTOCK COMPOSITES FOR RUN 38B

Date

Screen Size, Wt % Tyler Mesh	Acceptor: Dead-Burned Dolomite	Acceptor: Minnekahta Limestone	Screen Size, Wt % Tyler Mesh	Coal: Husky Char	Coal: Wyodak Subbituminous
+4			+6		
4 X 6		0.2	6 X 8	0.5	0
6 X 8	55.2	41.0	8 X 10	10.9	1.8
8 X 9		35.7	10 X 14	17.7	5.2
9 X 10	31.5	18.8	14 X 20	17.0	8.3
10 X 12		3.1	20 X 28	14.7	17.1
12 X 14	12.9	0.9	28 X 35	14.4	20.6
14 X 16		Tr	34 X 48	11.1	23.2
16 X 20	0.2	0	48 X 65	6.1	13.4
20 X 24		0	65 X 100	3.1	5.1
24 X 28	Tr	0	100 X 200	3.4	3.7
-28	0.2	0.3	200 X 325	0.7	0.8
			-325	0.3	0.8
Particle Density, lb/cu ft	205	160			
Ultimate Analysis, Wt %					
Moisture				0.74	0
C				73.54	68.42
H				3.18	4.67
N				0.74	0.79
S				1.21	0.71
Ash + SO_3				12.37	5.98
Elemental Analysis, Wt %					
SiO_2	1.38	3.20		44.20	37.00
SO_3	0.16	Tr		13.42	11.02
Na_2O	0.07	0.02		3.22	1.07
CaO	54.24	94.58		15.92	22.47
MgO	39.94	0.62		5.06	6.15
K_2O	0.1	0.06		0.50	0.33
P_2O_5	0.88	1.00		12.91	15.36
Al_2O_3	1.13	0.28		4.93	4.23
Fe_2O_3	0.01	0.03		0.09	0.70
TiO_2	0.04	0.02		0.38	0.65

Table 38-3. FEEDSTOCK COMPOSITES FOR RUN 38C

Date	7/7/76			7/8/76			7/9/76			7/10/76		
Time	0300	1100	1900	0300	1100	1900	0700	1100	1900	0300	1100	1500
Solids												
Feedstock	Wyodak Subbituminous											
Feed Rate, lb/hr[1]	2,340	2,340	2,470	2,550	2,550	2,550	2,550	2,340	2,340	2,340	2,340	2,340
Cyclone Solids, lb/hr	-	110	90	-	80	80	90	90	110	110	-	110
Pond Solids, lb/hr	55	47	45	37	29	28	30	26	-	-	-	-
Gas Flows[2]												
Boot Recycle, SCFH	16,230	12,240	10,500	8,010	8,640	8,510	8,790	8,120	7,350	6,280	6,910	6,970
Boot Steam, SCFH	18,880	23,500	27,610	29,900	30,360	30,390	29,680	30,200	30,410	30,940	29,470	29,310
CO_2 to Boot, SCFH	0	1,030	1,020	1,050	1,030	1,010	1,020	1,020	1,010	1,020	1,010	1,030
Steam to Side, SCFH	28,570	26,050	22,270	18,440	17,810	18,200	18,340	17,660	18,360	18,340	18,170	22,040
Air to Side, SCFH	18,960	13,180	9,270	4,280	2,530	2,550	2,290	2,270	2,120	2,160	2,150	2,120
Purges												
Recycle, SCFH	1,360	1,660	1,740	1,510	1,820	1,720	1,930	1,970	1,730	1,730	1,660	1,680
Inert, SCFH	1,900	1,500	1,750	1,350	1,550	1,750	1,780	1,330	1,570	1,500	1,330	590
Total Flow In, SCFH	86,900	79,160	74,160	64,540	63,740	64,130	63,830	62,570	62,550	61,970	60,700	63,740
Vent Rate, SCFH	57,200	61,440	55,110	49,740	49,580	50,330	52,080	48,960	48,180	46,881	50,010	52,840
Bed Conditions												
Boot Velocity, fps	1.94	2.00	2.12	2.12	2.18	2.17	2.15	2.13	2.11	2.08	2.04	2.04
Bed Velocity, fps	0.91	0.84	0.77	0.68	0.67	0.67	0.66	0.65	0.65	0.65	0.64	0.68
Boot Density, lb/ft^3[3]	99	96	87	68	80	78	71	72	69	68	66	63
Bed Density, lb/ft^3[3]	39	34	32	36	39	39	39	39	39	40	41	40
Boot Temperature, °F	1490	1514	1525	1526	1532	1534	1550	1537	1537	1541	1542	1544
Bed Temperature, °F	1500	1517	1509	1519	1522	1516	1520	1513	1516	1517	1522	1525
Bed Height, ft	16.6	25.4	25.0	26.0	25.0	25.2	27.0	26.8	25.40	24.40	24.60	25.4
Overhead Gas Compositions, Mol %												
CO	17.30	18.00	15.10	14.60	13.10	14.40	13.90	12.60	13.00	12.70	13.30	12.60
CO_2	13.40	13.40	14.00	13.30	9.80	7.60	8.40	11.70	9.80	9.90	10.00	9.10
N_2	26.90	22.50	17.40	13.00	8.20	6.90	8.40	7.20	8.70	9.50	7.80	8.30
H_2	33.20	38.00	43.40	47.60	55.50	57.70	55.60	56.00	55.30	54.20	55.60	56.70
CH_4	7.00	8.10	10.10	11.50	13.50	13.40	13.60	12.40	13.20	12.70	13.20	13.20

[1] Determined by feeder RPM; 9.81 X Bulk Density X RPM = 425*RPM.
[2] Determined by orifice flow measurements.
[3] Determined by differential pressure measurements.

Table 38-4. GASIFIER DATA FOR RUN 38A

Date	7/7/76			7/8/76		
Time	0300	1100	1900	0300	1100	1900
Solids						
Acceptor Feedstock	Dead-Burned Dolomite	Minnekahta Limestone				
Acceptor Makeup, lb/hr[5]	600	600	600	600	600	600
Acceptor Circulation, lb/hr[1]	11,510	9,710	11,230	12,130	11,200	11,820
Ash and Attrited Acceptor, lb/hr[2]	100	150	180	200	200	130
Acceptor Withdrawal, lb/hr[2]	360	400	300	280	370	490
Auxiliary Char Feed, lb/hr[5]	310	160	210	120	90	90
Gas Flows[3]						
Acceptor Lift, SCFH	54,940	54,320	54,260	53,930	53,700	53,700
Char Lift, SCFH	10,040	9,990	9,950	9,930	9,970	9,970
Air to Ring, SCFH	72,920	73,790	76,700	79,700	81,260	83,640
Recycle to Ring, SCFH	51,990	0	0	0	0	0
Purges						
Recycle, SCFH	2,030	2,940	2,540	2,660	2,180	3,200
Nitrogen, SCFH	2,160	2,160	2,520	2,220	2,220	2,110
Inert, SCFH	990	660	790	830	660	930
Total Flow In, SCFH	195,070	143,860	146,760	149,270	149,990	153,550
Vent Rate, SCFH	85,390	91,630	100,150	104,220	105,350	110,290
Bed Conditions						
Inlet Velocity, fps	3.56	2.84	2.67	2.68	2.72	2.76
Bed Density, lb/ft^3[4]	88	85	79	75	72	69
Average Bed Temperature, °F	1838	1845	1874	1845	1852	1851
Overhead Gas Analysis, Dry Mol %						
O_2	0.0	0.0	0.0	0.0	0.0	0.0
CO	2.60	1.47	3.25	2.15	2.42	3.74
CO_2	19.99	25.03	25.46	29.40	28.51	28.51
N_2	77.42	73.50	71.29	68.45	69.07	67.75

(1) Determined by lift line pressure drop.
(2) Determined by weigh scale.
(3) Determined by orifice flow measurements.
(4) Density determined by differential pressure.
(5) Determined by feeder RPM: Dead-burned dolomite, 360 X RPM; limestone, 281 X RPM; auxiliary fuel, 368 X RPM.

Table 38-5. REGENERATOR DATA FOR RUN 38A (Sheet 1 of 2)

Date	7/9/76			7/10/76		
Time	0700	1100	1900	0300	1100	1500
Solids						
Acceptor Feedstock	Minnekahta Limestone					
Acceptor Makeup, lb/hr[1]	600	600	600	600	600	600
Acceptor Circulation, lb/hr[2]	10,320	9,720	10,010	9,720	10,030	10,970
Ash and Attrited Acceptor, lb/hr[2]	130	190	110	100	-	-
Acceptor Withdrawal, lb/hr[2]	250	440	308	340	360	360
Auxiliary Char Feed, lb/hr[5]	20	50	150	190	310	240
Gas Flows[3]						
Acceptor Lift, SCFH	53,930	53,890	53,630	54,040	52,890	54,150
Char Lift, SCFH	10,030	9,960	9,870	10,020	10,060	10,000
Air to Ring, SCFH	77,640	78,980	81,560	80,720	83,780	82,610
Recycle to Ring, SCFH	0	0	0	0	0	0
Purges						
Recycle, SCFH	2,800	2,430	1,940	2,140	2,190	2,150
Nitrogen, SCFH	2,080	2,050	2,050	1,990	1,990	2,100
Inert, SCFH	830	830	600	890	890	790
Total Flow In, SCFH	147,310	148,140	149,650	149,800	151,800	151,800
Vent Rate, SCFH	100,520	100,780	105,800	105,140	108,260	106,640
Bed Conditions						
Inlet Velocity, fps	2.68	2.65	2.72	2.72	2.77	2.75
Bed Density, lb/ft^3[4]	59	62	60	57	57	57
Average Bed Temperature, ^oF	1877	1853	1857	1859	1852	1848
Overhead Gas Analysis, Dry Mol %						
O_2	0.0	0.0	0.0	0.0	0.0	0.0
CO	2.42	3.06	2.60	2.42	3.35	3.06
CO_2	30.29	28.51	28.07	27.63	26.76	26.32
N_2	67.29	68.43	69.33	69.96	69.90	70.62

(1) Determined by lift line pressure drop.
(2) Determined by weigh scale.
(3) Determined by orifice flow measurements.
(4) Density determined by differential pressure.
(5) Determined by feeder RPM: Dead-burned dolomite, 360 X RPM; limestone, 281 X RPM; auxiliary fuel, 368 X RPM.

Table 38-5. REGENERATOR DATA FOR RUN 38A (Sheet 2 of 2)

Date	7/24/76	← 7/25/76 →			← 7/26/76 →			7/27/76
Time	1900	0330	1100	1900	0400	1100	1900	0300
Solids								
Feedstock	Husky Char	← Wyodak Subbituminous →						
Feed Rate, lb/hr(1)	1,470	1,960	1,960	1,960	1,960	1,960	1,960	1,960
Cyclone Solids, lb/hr	-	-	50	-	-	90	90	-
Pond Solids, lb/hr	130	80	230	50	50	110	20	20
Gas Flows(2)								
Boot Recycle, SCFH	16,870	17,640	16,490	11,980	9,400	9,470	9,380	0
Boot Steam, SCFH	18,970	19,650	20,460	25,340	29,440	30,750	30,840	37,890
CO_2 to Boot, SCFH	0	0	980	1,020	1,020	1,010	960	980
Steam to Side, SCFH	28,480	28,520	26,470	23,030	19,670	18,110	18,080	17,610
Air to Side, SCFH	18,930	18,670	18,240	10,270	5,970	2,680	0	0
Purges								
Recycle, SCFH	1,840	1,660	1,490	1,620	1,750	840	870	1,880
Inert, SCFH	830	730	660	830	760	600	1,160	830
Total Flow In, SCFH	85,920	86,870	84,790	74,090	68,010	63,460	61,290	59,190
Vent Rate, SCFH	48,239	60,530	62,740	54,640	53,170	43,530	41,940	45,450
Bed Conditions								
Boot Velocity, fps	1.84	1.87	1.97	2.00	2.02	2.07	2.10	2.05
Bed Velocity, fps	0.88	0.88	0.88	0.76	0.63	0.64	0.62	0.60
Boot Density, lb/ft^3(3)	99	96	99	95	84	83	80	69
Bed Density, lb/ft^3(3)	42	43	41	37	36	36	37	36
Boot Temperature, ^oF	1470	1500	1520	1520	1530	1530	1530	1510
Bed Temperature, ^oF	1480	1490	1510	1510	1520	1520	1520	1510
Bed Height, ft	23.6	21.2	25.0	25.2	24.4	26.0	29.80	25.8
Overhead Gas Compositions, Dry-Mol %								
CO	10.20	13.50	14.20	10.30	12.60	14.80	14.00	13.20
CO_2	27.40	15.40	14.40	19.00	9.60	8.30	8.40	10.20
N_2	29.70	30.10	27.50	17.90	13.60	7.80	4.40	5.00
H_2	27.20	32.20	34.70	43.60	51.30	58.10	59.60	59.60
CH_4	5.50	8.70	9.20	9.20	12.90	12.60	13.60	12.00

(1) Determined by feeder RPM; 9.81 X Bulk Density X RPM = 425*RPM.
(2) Determined by orifice measurements.
(3) Determined by differential pressure measurements.

Table 38-6. GASIFIER DATA FOR RUN 38B

Date	7/24/76	← 7/25/76 →			← 7/26/76 →			7/27/76
Time	1900	0330	1100	1900	0400	1100	1900	0300
Solids								
Acceptor Feedstock	Dead-Burned Dolomite	←			Minnekahta Limestone			→
Acceptor Makeup, lb/hr[5]	300	300	600	600	600	600	600	600
Acceptor Circulation, lb/hr[1]	6,640	8,180	10,320	8,820	10,630	11,870	12,170	10,920
Ash and Attrited Acceptor, lb/hr[2]	-	180	80	170	170	220	160	-
Acceptor Withdrawal, lb/hr[2]	350	630	650	550	440	420	350	-
Auxiliary Char Feed, lb/hr[5]	120	290	360	330	330	210	260	290
Gas Flows[3]								
Acceptor Lift, SCFH	56,390	55,680	55,680	55,520	54,150	54,580	54,560	54,660
Char Lift, SCFH	10,200	10,130	10,210	10,230	10,330	10,470	10,330	10,460
Air to Ring, SCFH	57,290	59,410	67,830	76,230	78,480	76,820	78,550	84,480
Recycle to Ring, SCFH	33,540	33,410	24,840	20,640	15,370	0	0	0
Purges								
Recycle, SCFH	1,750	1,740	1,530	1,470	1,610	1,460	1,700	1,950
Nitrogen, SCFH	1,670	1,670	1,670	1,780	1,830	1,660	1,640	1,680
Inert, SCFH	370	950	500	950	950	770	1,030	1,240
Total Flow In, SCFH	161,210	162,990	162,310	166,820	162,720	145,660	147,710	154,470
Vent Rate, SCFH	67,120	72,470	88,400	100,180	101,790	103,910	105,920	97,910
Bed Conditions								
Inlet Velocity, fps	2.94	2.97	2.93	3.03	2.96	2.66	2.68	2.82
Bed Density, lb/ft^3[4]	86	97	94	87	74	65	68	63
Average Bed Temperature, ^oF	1845	1850	1820	1840	1850	1860	1850	1860
Overhead Gas Analysis, Dry Mol %								
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	5.20	3.44	4.04	3.74	3.35	3.06	2.60	4.67
CO_2	17.15	19.17	22.06	23.74	27.19	28.07	27.63	26.76
N_2	77.64	77.39	73.90	72.52	69.46	68.87	69.77	68.58

[1] Determined by lift line pressure drop.
[2] Determined by weigh scale.
[3] Determined by orifice flow measurements.
[4] Density determined by differential pressure.
[5] Determined by feeder RPM: Dead-burned dolomite, 360 X RPM; limestone, 281 X RPM; auxiliary fuel, 368 X RPM.

Table 38-7. REGENERATOR DATA FOR RUN 38B

Date	← 8/14/76 →			← 8/15/76 →			← 8/16/76 →			8/17/76	
Time	0700	1500	2300	0700	1500	2300	0700	1500	2300	0300	0700
Solids											
Feedstock	Husky Char		← Wyodak Subbituminous →								
Feed Rate, lb/hr[1]	890	2,340	1,340	1.910	1,820	1,720	1,720	1,910	2,100	2,100	2,100
Cyclone Solids, lb/hr	-	-	60	95	84	93	93	182	52	52	101
Pond Solids, lb/hr	-	-	-	58	54	62	62	72	70	74	74
Gas Flows[2]											
Boot Recycle, SCFH	17,130	19,270	17,990	18,140	14,380	9,340	8,920	9,210	10,080	10,730	10,060
Boot Steam, SCFH	20,660	20,090	19,240	16,740	21,630	27,410	28,820	28,070	27,670	27,860	27,590
CO_2 to Side, SCFH	0	0	0	0	0	0	960	950	990	970	970
Steam to Side, SCFH	28,630	28,720	28,830	28,720	28,480	24,570	24,490	24,630	28,360	25,720	24,830
Air to Side, SCFH	19,120	19,010	18,940	19,070	14,540	6,670	5,190	5,230	9,040	9,070	9,550
Purges											
Recycle, SCFH	-	-	-	3,220	3,430	4,280	3,780	4,370	4,510	4,520	4,160
Inert, SCFH	-	-	-	350	340	380	290	280	230	290	330
Nitrogen, SCFH	-	-	-	1,670	1,680	1,820	1,940	1,640	1,540	1,510	1,510
Total Flow In, SCFH	85,540	87,090	85,000	87,910	84,480	74,470	74,390	74,380	82,420	80,670	79,000
Vent Rate, SCFH	52,970	54,840	54,040	62,450	56,850	45,760	45,880	51,770	62,020	61,740	60,720
Bed Conditions											
Boot Velocity, fps	1.95	2.02	1.93	2.28	2.11	1.98	1.99	2.04	2.08	2.12	2.09
Bed Velocity, fps	0.90	0.91	0.90	0.97	0.89	0.74	0.74	0.75	0.83	0.81	0.80
Boot Density, lb/ft^3[3]	95	93	93	99	98	90	80	77	72	71	71
Bed Density, lb/ft^3[3]	45	46	46	40	37	36	35	39	38	38	40
Boot Temperature, ^oF	1472	1449	1495	1492	1515	1521	1523	1538	1533	1536	1541
Bed Temperature, ^oF	1484	1458	1500	1491	1508	1519	1519	1529	1518	1519	1527
Bed Height, ft	24.8	21.2	20.6	25.2	25.0	25.0	24.4	25.6	25.2	26.0	25.6
Overhead Gas Compositions, Dry Mol %											
CO	13.60	25.90	20.20	17.00	17.80	14.90	16.60	14.10	14.40	13.80	14.50
CO_2	18.50	4.40	7.80	13.30	13.70	13.50	10.70	10.40	9.00	7.50	9.90
N_2	33.40	33.60	34.70	27.0	26.10	19.50	15.30	12.50	12.40	12.70	16.30
H_2	31.80	32.80	33.40	35.30	35.20	42.90	47.70	52.70	53.10	53.90	48.90
CH_4	2.70	3.30	3.80	7.40	7.10	9.10	10.20	10.20	11.00	12.00	10.30

(1)
(2) Determined by feeder RPM: Bulk Density X 9.81 X RPM = 425*RPM.
(3) Determined by orifice flow measurements.
Determined by differential pressure measurement.

Table 38-8. GASIFIER DATA FOR RUN 38C (Sheet 1 of 3)

Date	8/17/76		8/18/76			8/20/76			8/21/76	8/23/76	
Time	1500	2300	1500	1900	2300	0700	1500	2300	0700	0700	1500
Solids					Wyodak Subbituminous						
Feedstock Feed Rate, lb/hr[1]	1,720	1,720	770	1,150	1,150	1,340	1,340	1,720	1,720	1,910	2,410
Cyclone Solids, lb/hr	157	126	102	102	137	131	164	184	190	105	112
Pond Solids, lb/hr	67	61	76	41	41	-	77	111	66	117	-
Gas Flows[2]											
Boot Recycle, SCFH	10,320	10,320	9,580	9,600	10,170	14,110	10,770	10,960	12,290	25,390	19,440
Boot Steam, SCFH	27,610	27,190	29,590	29,610	28,890	23,000	25,580	25,110	25,760	18,220	21,530
CO_2 to Side, SCFH	950	970	0	0	0	960	920	970	960	980	940
Steam to Side, SCFH	24,880	24,880	24,450	24,460	24,500	28,390	24,800	24,840	24,660	28,800	28,410
Air to Side, SCFH	3,820	3,740	8,260	8,230	8,200	13,150	10,890	11,010	10,160	10,540	13,030
Purges											
Recycle, SCFH	3,980	4,750	4,430	4,510	4,800	4,030	4,110	4,720	3,500	1,900	1,780
Inert, SCFH	400	320	320	350	380	320	420	250	340	390	410
Nitrogen, SCFH	1,330	1,250	1,360	1,710	1,330	970	1,330	1,080	1,030	1,140	1,270
Total Flow In, SCFH	73,290	73,420	77,940	78,470	78,270	84,930	78,820	78,940	78,700	87,360	61,240
Vent Rate, SCFH	43,940	42,690	41,240	40,120	40,530	53,060	17,030	52,420	50,480	52,160	64,510
Bed Conditions											
Boot Velocity, fps	2.08	2.07	2.13	2.13	2.09	2.05	1.96	2.01	2.07	2.20	2.18
Bed Velocity, fps	0.74	0.74	0.78	0.77	0.77	0.86	0.79	0.80	0.80	0.87	0.90
Boot Density, lb/ft^3[3]	69	65	63	63	63	66	65	65	63	65	62
Bed Density, lb/ft^3[3]	37	39	31	33	34	39	39	41	40	36	37
Boot Temperature, °F	1531	1533	1525	1517	1518	1551	1540	1541	1540	1558	1561
Bed Temperature, °F	1520	1522	1503	1491	1491	1518	1514	1518	1518	1520	1532
Bed Height, ft	25.6	25.4	23.4	19.0	19.0	24.6	24.0	25.0	25.0	27.0	23.6
Overhead Gas Compositions, Dry Mol %											
CO	14.60	14.80	10.40	9.30	9.00	13.40	12.50	13.40	12.80	14.6	15.70
CO_2	7.60	9.90	12.00	13.20	11.40	12.80	11.70	11.20	10.20	8.2	7.10
N_2	16.50	17.00	19.40	20.10	21.10	21.00	20.40	19.50	19.60	21.0	19.20
H_2	51.50	48.30	50.30	48.80	48.60	45.50	47.30	46.70	47.70	46.6	47.20
CH_4	9.80	10.00	7.80	8.60	9.90	7.20	8.00	9.10	9.60	9.6	10.80

(1) Determined by feeder RPM: Bulk Density X 9.81 X RPM = 425*RPM.
(2) Determined by orifice flow measurement.
(3) Determined by differential pressure measurement.

Table 38-8. GASIFIER DATA FOR RUN 38C (Sheet 2 of 3)

Date	8/23/76	← 8/24/76 →			← 8/25/76 →			← 8/26/76 →			8/27/76
Time	2300	0700	1500	2300	0700	1500	2300	0700	1500	2300	0700
Solids											
Feedstock	← Wyodak Subbituminous →										
Feed Rate, lb/hr(1)	2,560	2,390	2,390	2,390	2,450	2,300	2,410	2,410	2,410	2,410	2,410
Cyclone Solids, lb/hr	130	222	189	106	106	147	165	188	146	138	151
Pond Solids, lb/hr	62	47	45	65	46	56	40	37	52	52	-
Gas Flows(2)											
Boot Recycle, SCFH	14,200	13,300	10,600	10,390	10,770	10,250	10,170	10,480	10,180	10,340	10,390
Boot Steam, SCFH	26,870	26,860	29,470	29,020	28,770	29,540	29,250	28,770	29,530	29,510	28,770
CO_2 to Side, SCFH	950	970	960	970	980	950	970	990	941	980	990
Steam to Side, SCFH	24,670	24,840	24,420	24,450	24,420	24,380	24,440	24,470	24,310	24,400	24,420
Air to Side, SCFH	9,290	6,160	6,150	6,120	6,050	6,230	6,110	6,130	6,160	6,240	6,270
Purges											
Recycle, SCFH	1,960	2,040	2,060	2,820	3,000	3,050	3,090	3,020	3,020	2,940	3,180
Inert, SCFH	370	420	450	420	320	320	460	460	410	440	510
Nitrogen, SCFH	1,330	1,250	1,270	1,330	1,140	1,330	1,390	1,080	1,270	1,080	1,080
Total Flow In, SCFH	79,640	78,840	75,380	75,520	75,450	76,050	75,880	75,400	75,320	75,930	75,610
Vent Rate, SCFH	59,200	52,850	56,630	55,460	53,800	51,140	55,360	54,590	54,840	55,430	57,430
Bed Conditions											
Boot Velocity, fps	2.10	2.13	2.08	2.07	2.05	2.13	2.10	2.07	2.12	2.10	2.05
Bed Velocity, fps	0.80	0.78	0.76	0.76	0.75	0.77	0.76	0.76	0.77	0.77	0.80
Boot Density, lb/ft^3(3)	60	62	62	62	57	62	62	62	60	62	63
Bed Density, lb/ft^3(3)	35	37	38	38	37	40	40	38	38	39	38
Boot Temperature, ^oF	1539	1539	1542	1541	1527	1539	1531	1525	1532	1527	1529
Bed Temperature, ^oF	1522	1525	1528	1530	1515	1532	1519	1514	1522	1516	1520
Bed Height, ft	23.2	25.4	25.2	24.8	24.8	25.0	24.2	25.0	25.6	25.0	25.0
Overhead Gas Compositions, Dry Mol %											
CO	14.20	13.90	15.00	14.50	11.00	14.60	13.50	13.10	14.50	13.70	13.90
CO_2	9.00	6.80	7.40	8.90	9.90	9.00	10.10	10.30	8.00	8.50	7.70
N_2	15.40	14.30	11.50	12.00	13.10	12.30	12.80	13.90	12.80	13.30	14.40
H_2	49.60	52.70	54.10	52.70	50.80	52.40	51.20	50.20	52.40	53.90	51.50
CH_4	11.80	12.20	12.00	11.90	12.20	11.60	12.30	12.40	12.30	12.60	12.40

(1)
(2) Determined by feeder RPM: Bulk Density X 9.81 X RPM = 425*RPM.
(3) Determined by orifice flow measurement.
Determined by differential pressure measurement.

Table 38-8. GASIFIER DATA FOR RUN 38C (Sheet 3 of 3)

Date	8/14/76			8/15/76			8/16/76		
Time	0700	1500	2300	0700	1500	2300	0700	1500	2300
Solids									
Acceptor Feedstock	Dead-Burned Dolomite			Minnekahta Limestone					
Acceptor Makeup, lb/hr[5]	360	360	360	560	560	560	560	560	560
Acceptor Circulation, lb/hr[1]	5,220	9,050	9,080	7,550	7,580	10,650	10,640	11,690	8,700
Ash and Attrited Acceptor, lb/hr[2]	-	-	-	-	-	-	-	215	167
Acceptor Withdrawal, lb/hr[2]	649	595	668	652	484	431	334	588	305
Auxiliary Char Feed, lb/hr[5]	86	103	121	128	328	397	431	380	380
Gas Flows[3]									
Acceptor Lift, SCFH	55,170	56,170	56,170	56,270	55,520	55,370	54,950	54,900	55,130
Char Lift, SCFH	10,200	9,990	10,340	10,230	10,210	10,210	10,210	10,150	10,190
Air to Ring, SCFH	66,610	56,550	57,330	61,210	67,760	77,320	79,120	81,510	80,340
Recycle to Ring, SCFH	46,980	18,070	18,070	24,500	12,610	5,240	0	0	0
Purges									
Recycle, SCFH	-	-	-	2,490	2,450	3,100	2,440	2,690	2,750
Nitrogen, SCFH	-	-	-	360	370	380	400	360	350
Inert, SCFH	-	-	-	950	850	980	110	510	450
Total Flow In, SCFH	178,960	140,780	141,910	156,010	149,770	152,600	147,230	150,120	149,210
Vent Rate, SCFH	81,970	69,230	70,150	76,360	87,921	102,590	104,460	111,280	111,870
Bed Conditions									
Inlet Velocity, fps	3.32	2.64	2.66	2.86	2.72	2.78	2.71	2.74	2.73
Bed Density, lb/ft^3[4]	90	94	94	95	90	87	75	71	67
Average Bed Temperature, ^oF	1832	1856	1850	1857	1835	1855	1856	1849	1853
Overhead Gas Analysis, Dry Mol %									
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	6.81	8.68	3.84	2.60	3.25	3.64	2.97	4.56	4.56
CO_2	16.75	17.15	17.15	18.76	23.74	23.32	26.32	24.60	24.17
N_2	76.44	74.17	79.01	78.64	73.01	73.04	70.71	70.84	71.27

(1)
(2) Determined by lift line pressure drop.
(3) Determined by weigh scale.
(4) Determined by orifice flow measurements.
(5) Density determined by differential pressure.
Determined by feeder RPM: Limestone, 281 X RPM; dead-burned dolomite, 360 X RPM; auxiliary fuel, 368 X RPM.

Table 38-9. REGENERATOR DATA FOR RUN 38C (Sheet 1 of 4)

Date	8/17/76				8/18/76			8/19/76
Time	0300	0700	1500	2300	1500	1900	2300	0700
Solids								
Acceptor Feedstock	Minnekahta Limestone							
Acceptor Makeup, lb/hr[5]	560	560	560	560	560	560	560	840
Acceptor Circulation, lb/hr[1]	8,200	8,000	8,760	9,410	3,780	3,830	3,280	2,610
Ash and Attrited Acceptor, lb/hr[2]	80	80	60	160	227	227	130	265
Acceptor Withdrawal, lb/hr[2]	305	687	275	464	0	420	461	0
Auxiliary Char Feed, lb/hr[5]	242	207	485	414	621	621	621	346
Gas Flows[3]								
Acceptor Lift, SCFH	54,640	54,970	54,680	54,730	54,590	53,930	53,800	55,330
Char Lift, SCFH	10,220	10,220	10,150	10,170	10,100	10,150	10,190	10,050
Air to Ring, SCFH	76,610	75,580	80,970	78,290	62,400	66,120	66,030	72,940
Recycle to Ring, SCFH	0	0	0	0	0	0	0	0
Purges								
Recycle, SCFH	2,690	2,640	2,450	3,030	2,860	2,960	3,090	2,250
Nitrogen, SCFH	350	330	320	320	330	370	330	290
Inert, SCFH	480	490	1,110	980	210	780	980	1,410
Total Flow In, SCFH	144,990	144,230	149,680	147,520	130,490	134,310	134,420	142,270
Vent Rate, SCFH	105,850	104,040	110,770	108,910	70,360	91,100	92,220	99,910
Bed Conditions								
Inlet Velocity, fps	2.66	2.64	2.74	2.67	2.38	2.44	2.45	2.66
Bed Density, lb/ft^3[4]	64	66	62	59	60	58	57	53
Average Bed Temperature, ^oF	1864	1854	1857	1844	1855	1848	1861	1858
Overhead Gas Analysis, Dry Mol %								
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	2.15	2.15	3.54	3.35	1.98	3.74	2.60	2.69
CO_2	25.89	25.89	24.17	25.89	22.48	24.64	23.74	25.46
N_2	71.96	71.96	72.29	70.77	75.55	74.62	73.66	71.86

(1)
(2) Determined by lift line pressure drop.
(3) Determined by weigh scale.
(4) Determined by orifice flow measurements.
(5) Density determined by differential pressure.
Determined by feeder RPM: Limestone, 281 X RPM; dead-burned dolomite, 360 X RPM; auxiliary fuel, 368 X RPM.

Table 38-9. REGENERATOR DATA FOR RUN 38C (Sheet 2 of 4)

Date	8/20/76		8/21/76	← 8/23/76 →				8/24/76
Time	1500	2300	0700	0700	1500	2300	0700	1500
Solids								
Acceptor Feedstock	← Minnekahta Limestone →							
Acceptor Makeup, lb/hr[5]	560	0	560	560	560	560	560	560
Acceptor Circulation, lb/hr[1]	3,760	3,730	3,720	3,790	6,140	6,700	7,600	8,200
Ash and Attrited Acceptor, lb/hr[2]	295	180	205	169	202	180	160	142
Acceptor Withdrawal, lb/hr[2]	313	461	263	140	140	190	190	243
Auxiliary Char Feed, lb/hr[5]	569	500	449	138	104	121	104	104
Gas Flows[3]								
Acceptor Lift, SCFH	55,100	55,140	55,260	54,340	53,660	54,690	55,280	56,000
Char Lift, SCFH	9,990	10,060	10,030	10,250	10,120	10,330	10,290	10,130
Air to Ring, SCFH	69,130	72,700	75,620	49,610	76,860	78,350	82,180	83,020
Recycle to Ring, SCFH	12,520	10,060	16,740	12,340	17,270	15,530	13,480	13,530
Purges								
Recycle, SCFH	2,210	2,210	2,250	1,220	1,120	1,220	1,220	1,220
Nitrogen, SCFH	330	390	290	310	320	330	320	320
Inert, SCFH	1,060	440	1,290	1,710	1,710	1,710	1,710	1,710
Total Flow In, SCFH	150,340	150,910	161,480	129,780	161,060	162,160	164,480	165,430
Vent Rate, SCFH	95,300	101,840	100,270	98,420	104,460	106,320	107,430	110,540
Bed Conditions								
Inlet Velocity, fps	2.74	2.96	2.95	2.33	2.92	2.94	2.99	3.03
Bed Density, lb/ft^3[4]	59	59	59	53	47	56	57	57
Average Bed Temperature, °F	1840	1844	1849	1842	1841	1821	1838	1839
Overhead Gas Analysis, Dry Mol %								
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	2.33	2.60	2.60	3.55	2.60	1.72	1.35	2.51
CO_2	23.74	23.74	25.03	25.89	25.89	25.89	26.32	26.32
N_2	73.93	73.66	72.38	70.77	71.52	72.39	70.33	71.17

(1) Determined by lift line pressure drop.
(2) Determined by weigh scale.
(3) Determined by orifice flow measurements.
(4) Density determined by differential pressure.
(5) Determined by feeder RPM: Limestone, 281 X RPM; dead-burned dolomite, 360 X RPM; auxiliary fuel, 368 X RPM.

Table 38-9. REGENERATOR DATA FOR RUN 38C (Sheet 3 of 4)

Date	8/24/76	← 8/25/76 →			← 8/26/76 →			8/27/76
Time	2300	0700	1500	2300	0700	1500	2300	0700
Solids								
Acceptor Feedstock	← Minnekahta Limestone →							
Acceptor Makeup, lb/hr(5)	980	980	560	560	560	560	560	560
Acceptor Circulation, lb/hr(1)	6,690	8,220	9,120	7,300	6,680	7,600	6,990	6,680
Ash and Attrited Acceptor, lb/hr(2)	140	165	177	157	143	244	114	128
Acceptor Withdrawal, lb/hr(2)	314	0	280	473	330	272	349	426
Auxiliary Char Feed, lb/hr(5)	104	104	104	259	59	52	83	86
Gas Flows(3)								
Acceptor Lift, SCFH	55,160	55,550	54,550	54,560	55,430	55,200	55,310	55,250
Char Lift, SCFH	10,270	10,290	10,220	10,280	10,350	10,230	10,270	10,360
Air to Ring, SCFH	80,670	73,900	84,120	84,400	82,600	81,070	83,310	82,610
Recycle to Ring, SCFH	13,570	12,620	12,390	12,400	12,480	12,430	12,450	12,440
Purges								
Recycle, SCFH	1,710	1,860	1,850	1,900	1,860	1,850	1,800	1,940
Nitrogen, SCFH	340	310	330	330	300	320	300	300
Inert, SCFH	1,710	1,200	850	1,670	1,710	1,410	1,470	1,710
Total Flow In, SCFH	163,430	155,730	164,310	165,540	164,730	162,510	164,910	164,610
Vent Rate, SCFH	105,690	92,210	105,700	108,250	108,170	105,270	109,500	107,680
Bed Conditions								
Inlet Velocity, fps	3.02	2.83	3.01	3.03	2.99	2.97	3.02	3.00
Bed Density, lb/ft^3(4)	57	54	59	59	59	58	59	59
Average Bed Temperature, ^oF	1874	1836	1842	1851	1837	1848	1847	1843
Overhead Gas Analysis, Wt %								
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	2.24	4.35	2.15	2.97	3.54	1.98	2.33	2.15
CO_2	25.46	24.17	26.32	26.32	25.89	26.32	26.76	28.07
N_2	72.32	71.48	71.53	70.71	70.57	71.70	70.92	69.78

(1)
(2) Determined by lift line pressure drop.
(3) Determined by weigh scale.
(4) Determined by orifice flow measurements
(5) Density determined by differential pressure.
Determined by feeder RPM: Limestone, 281 X RPM; dead-burned dolomite, 360 X RPM; auxiliary fuel, 368 X RPM.

Table 38-9. REGENERATOR DATA FOR RUN 38C (Sheet 4 of 4)

Date	7/6/76		7/7/76		7/8/76		7/9/76		7/10/76	
Time	0800	2000	0800	1945	0800	2010	0800	2000	0800	1200
Screen Size, Wt %										
Tyler Mesh										
+4					7.2		6.6	↓	4.4	↓
4 X 6	0.1	0.4	0.2	9.3	13.4	32.1	20.6	51.1	41.5	52.5
6 X 8	1.0	↓	0.8	↓	8.3	↓	14.5	↓	21.9	↓
8 X 9	9.4	10.7	11.1	9.8	18.7	26.1	16.6	28.7	14.4	31.9
9 X 10	46.7	↓	45.3	↓	21.9	↓	19.4	↓	9.0	↓
10 X 12	28.9	73.4	27.5	59.2	15.4	31.9	12.4	16.5	4.4	10.6
12 X 14	10.5	↓	11.8	↓	11.3	↓	5.3	↓	1.7	↓
14 X 16	2.8	15.2	2.6	19.4	2.3	7.2	1.5	2.0	0.9	1.6
16 X 20	0.3	↓	0.4	↓	0.6	↓	0.6	↓	0.6	↓
20 X 24	Tr	0.3	Tr	1.4	0.2	1.9	0.2	1.3	0.3	1.8
24 X 28	0.2	0.1	0.4	0.8	0.6	0.7	1.2	0.4	1.0	1.6
-28										
% Calcine Weight Change	-1.6		-0.4		-0.8		-0.5		-3.2	
% Sulfide	0.05		0.02		0.03		0.12		0.05	
Elemental Analysis, Wt %										
SiO_2	1.39		2.97		4.72		5.70		5.49	
SO_3	0.34		0.30		0.24		0.95		0.34	
Na_2O	0.09		0.13		0.10		0.08		0.05	

Table 38-10. CIRCULATED ACCEPTOR, CALCINED FOR RUN 38A

Date	7/24/76	7/25/76	7/26/76	7/27/76
Time	0820	0800	0750	0400
Screen Size, Wt %				
Tyler Mesh				
+4				
4 X 6	Tr			
6 X 8	0.5	0.1	8.2	30.2
8 X 9	0.5	0.4	12.0	
9 X 10	8.8	5.8	16.9	34.0
10 X 12	38.8	34.4	28.6	
12 X 14	28.4	34.5	20.0	28.2
14 X 16	15.3	18.5	9.3	
16 X 20	6.6	5.4	2.5	6.4
20 X 24	0.9	0.6	0.6	
24 X 28	Tr	0.1	0.1	1.0
-28	0.2	0.4	1.8	0.2
% Calcine Weight Change	-0.3	-0.1	-0.2	-0.3
% Sulfide	0.01	0.03	0.12	0.06
Elemental Analysis, Wt %				
SiO_2	0.69	3.06	6.78	8.46
SO_3	0.10	0.10	0.33	0.39

Table 38-11. CIRCULATED ACCEPTOR, CALCINED FOR RUN 38B

Date	8/14/76	8/15/76	8/16/76	8/17/76		8/18/76		8/19/76	8/20/76
Time	1400	0800	0800	0400	0800	0800	1545	0400	0800
Screen Size, Wt %									
Tyler Mesh									
+4			0.2	0.3	0.2	0.7	0.6	0.3	0.2
4 X 6	0.1	0.3	11.7	23.0	24.6	30.9	35.2	37.0	33.9
6 X 8	1.3		14.5	21.8	24.9	25.8	26.1	28.4	30.2
8 X 9	3.5	5.6	15.1	14.9	14.9	18.1	16.9	16.5	17.9
9 X 10	42.4		29.3	17.9	15.0	10.9	9.9	8.3	7.8
10 X 12	32.4	77.3	18.8	12.3	10.7	6.7	5.8	5.3	4.8
12 X 14	10.4		7.1	5.4	5.0	2.7	2.3	2.6	1.8
14 X 16	9.0	15.8	2.6	2.6	2.6	2.4	1.9	1.1	1.0
16 X 20	0.7		0.4	0.4	0.5	0.4	0.4	0.3	0.2
20 X 24	0.2	2.9	0.2	Tr	Tr	0.2	0.1	Tr	0.3
24 X 28	0.1	Tr	0.1	1.4	1.6	1.2	0.8	0.2	1.8
-28									
% Calcine Weight Change	-0.4	-0.3	-0.6	-0.8	-0.9	-2.3	-0.8	-1.7	-9.0
% Sulfide	0.07		0.05	0.06		0.07			0.17
Elemental Analysis, Wt %									
SiO_2	3.79	6.29	7.61	8.99	8.36	9.20	10.52	8.87	10.17
SO_3	0.04	Tr	0.30	0.42	0.27	0.27	0.53	0.87	0.78
Na_2O	0.10	0.23	0.24	0.23	0.29	0.35	0.33	0.29	0.20

Table 38-12. CIRCULATED ACCEPTOR, CALCINED FOR RUN 38C (Sheet 1 of 2)

Date	8/21/76	8/23/76	8/24/76		8/25/76		8/26/76	8/27/76	
Time	0800	0800	0800	1540	0800	2000	0910	2000	0415
Screen Size, Wt % Tyler Mesh									
+4									
4 X 6	0.5	0.3	0.6	0.6	0.6	0.4	0.2	0.5	0.8
6 X 8	38.6	43.9	47.3	55.6	46.4	50.9	37.3	51.9	47.9
8 X 9	29.0	31.0	31.3	28.1	27.4	26.1	30.8	27.6	29.1
9 X 10	16.3	14.7	12.4	10.7	13.6	12.4	17.3	12.8	10.7
10 X 12	7.3	5.4	4.0	2.4	5.5	4.3	7.1	3.0	5.9
12 X 14	4.1	2.5	2.2	1.5	3.4	0.7	4.0	1.2	2.7
14 X 16	1.9	1.0	0.4	0.5	0.9	1.0	1.0	0.6	0.7
16 X 20	1.3	0.7	0.6	Tr	0.9	1.1	1.3	1.0	0.5
20 X 24	0.4	0.3	0.4	0.2	0.6	0.6	0.5	0.6	0.6
24 X 28	Tr	Tr	0.3	0.1	0.4	1.2	Tr	0.1	0.6
-28	0.4	0.2	0.3	0.3	0.2	1.3	0.5	0.7	0.5
% Calcine Weight Change	-0.7	-1.2	-1.4	-1.2	-0.2	-3.9	-3.2	-1.4	-3.4
% Sulfide	0.08	0.05		0.06		0.05	0.12	0.05	0.06
Elemental Analysis, Wt %									
SiO_2	5.20	8.33	5.52	4.67	6.64	7.85	5.83	5.45	5.59
SO_3	0.39	0.27	0.20	0.13	0.32	0.21	0.63	0.18	0.18
Na_2O	0.10	0.18	0.04	0.03	0.05	0.05	0.06	0.08	0.02

Table 38-12. CIRCULATED ACCEPTOR, CALCINED FOR RUN 38C (Sheet 2 of 2)

Date	7/6/76	7/7/76	7/8/76	7/9/76
Time	0800	0800	0800	0000
Screen Size, Wt %				
Tyler Mesh				
+4	↓	↓	↓	↓
4 X 6		0.4	5.4	
6 X 8	Tr	0.5	8.1	21.3
8 X 9	1.5	0.9	7.6	↓
9 X 10	9.4	8.9	11.4	22.6
10 X 12	33.1	26.3	27.0	↓
12 X 14	29.2	32.8	20.5	39.4
14 X 16	18.6	20.1	12.0	↓
16 X 20	6.1	7.2	4.9	12.1
20 X 24	1.0	1.3	1.2	↓
24 X 28	0.1	0.4	0.7	3.2
-28	1.1	1.2	1.2	1.4
Particle Density, lb/cu ft	174	188	130	138
% Calcine Weight Change	-4.9	-1.5	-3.9	-5.7
Activity	-	-	0.10	0.10
Elemental Analysis, Wt %				
SiO_2	2.46	5.67	5.66	7.79
SO_3	0.39	0.46	0.27	0.71
Na_2O	0.07	0.04	0.07	0.11
CaO	58.99	56.51	67.95	68.63
MgO	34.97	33.73	22.03	18.50
K_2O	0.02	0.01	0.02	0.02
Al_2O_3	1.09	1.76	1.92	2.57
Fe_2O_3	1.38	1.50	1.27	1.45
P_2O_5	0.01	0.02	0.03	0.05
TiO_2	0.07	0.07	0.09	0.09

Table 38-13. CIRCULATED ACCEPTOR, RECARBONATED FOR RUN 38A

Date	7/24/76	7/25/76	7/26/76	7/27/76
Time	0800	0800	0930	0400
Screen Size, Wt %				
Tyler Mesh				
+4				
4 X 6	Tr		Tr	
6 X 8	0.3	1.2	6.2	15.7
8 X 9	0.5	0.1	11.6	
9 X 10	4.3	4.5	14.5	31.4
10 X 12	26.8	25.2	22.3	
12 X 14	30.0	31.9	17.8	36.6
14 X 16	23.0	23.4	12.1	
16 X 20	11.5	10.7	6.4	11.7
20 X 24	2.5	1.9	3.0	
24 X 28	0.7	0.8	2.7	2.9
-28	0.5	1.0	3.3	1.6
Particle Density, lb/cu ft	193	192	120	140
% Calcine Weight Change	-3.4	-1.2	-5.8	-7.1
Activity			0.03	0.05
Elemental Analysis, Wt %				
SiO_2	1.61	6.12	6.07	10.10
SO_3	0.17	0.07	0.22	0.50
Na_2O	0.02	0.07	0.09	0.11
CaO	61.01	57.17	67.70	68.00
MgO	34.43	32.18	22.17	16.33
K_2O	0.02	0.02	0.04	0.04
Al_2O_3	1.19	2.09	2.23	2.77
Fe_2O_3	1.38	1.38	1.43	1.38
P_2O_5	0.01	0.02	0.06	0.04
TiO_2	0.07	0.09	0.15	0.14

Table 38-14. CIRCULATED ACCEPTOR, RECARBONATED FOR RUN 38B

Date	8/14/76	8/15/76	8/16/76	8/17/76		8/18/76	8/19/76	8/20/76	8/21/76
Time	1600	0800	0800	0415	0800	1645	0400	0800	0800
Screen Size, Wt %									
Tyler Mesh									
+4									
4 X 6			0.1	Tr		0.1	0.2	Tr	0.2
6 X 8	0.2	0.2	6.2	13.3	15.1	20.5	23.1	23.1	25.7
8 X 9	2.1		10.0	17.7	19.6	18.3	20.7	24.8	26.8
9 X 10	3.2	4.7	14.8	15.2	15.3	15.2	13.9	19.0	16.8
10 X 12	37.1		27.7	20.9	18.1	11.1	10.8	9.9	9.0
12 X 14	25.8	64.0	21.5	15.1	13.5	11.0	9.5	7.2	5.8
14 X 16	17.8		11.6	8.9	8.2	6.6	7.3	4.9	4.3
16 X 20	9.5	27.3	5.1	5.4	5.5	6.7	6.9	5.3	4.6
20 X 24	2.0		1.4	2.0	2.1	4.6	3.3	2.8	2.9
24 X 28	1.0	3.4	0.7	1.0	1.1	2.9	1.8	1.9	2.0
-28	1.3	0.4	1.0	1.4	1.6	3.0	2.5	1.2	1.8
Particle Density, lb/cu ft			159	125	124	112	120	122	118
% Calcine Weight Change	-2.4	-1.4	-6.5	-8.0	-8.6	-9.6	-9.5	-15.7	-12.1
Activity			0.07	0.16	0.16	0.16	0.14	0.25	0.18
Elemental Analysis, Wt %									
SiO_2	3.90	6.18	7.60	9.79		10.32	11.49	11.20	11.46
SO_3	0.10	0.08	0.37	0.46		0.56	0.61	0.56	0.59
Na_2O	0.20	0.26	0.22	0.55		0.39	0.55	0.42	0.34
CaO	52.91	55.70	63.04	61.27		72.04	73.06	77.41	78.96
MgO	40.69	35.25	25.57	23.22		10.42	7.91	4.84	3.59
K_2O	0.02	0.03	0.03	0.08		0.10	0.11	0.10	0.09
Al_2O_3	1.18	1.07	1.71	2.32		2.89	3.13	2.98	2.16
Fe_2O_3	1.39	1.28	1.16	1.47		1.67	1.87	1.75	1.80
P_2O_5	0.03	0.03	0.05	0.05		0.09	0.04	0.05	0.04
TiO_2	0.04	0.02	0.07	0.08		0.16	0.19	0.16	0.17

Table 38-15. CIRCULATED ACCEPTOR, RECARBONATED FOR RUN 38C (Sheet 1 of 2)

Date	8/23/76	8/24/76		8/25/76		8/26/76		8/27/76
Time	0800	0800	2000	0800	2000	1200	1600	0800
Screen Size, Wt % Tyler Mesh								
+4		0.3	0.2	0.2	0.2	0.3	0.3	0.3
4 X 6	22.7	27.2	33.8	30.0	32.9	33.7	28.5	27.9
6 X 8	25.1	28.1	25.8	27.4	27.6	25.2	26.1	28.5
8 X 9	18.6	18.1	17.1	18.5	17.4	16.5	17.1	17.9
9 X 10	8.8	8.2	8.5	9.0	8.4	6.7	7.9	8.0
10 X 12	5.5	5.0	5.0	5.1	4.7	4.3	5.1	4.5
12 X 14	3.9	2.6	2.3	2.1	2.0	2.8	3.5	1.9
14 X 16	4.8	3.1	2.0	2.8	2.2	3.2	3.5	2.8
16 X 20	4.0	2.8	1.7	2.0	1.8	2.5	2.4	2.4
20 X 24	3.4	2.1	1.4	1.3	1.2	1.5	3.1	2.4
24 X 28	3.1	2.7	2.0	1.7	1.6	3.3	2.5	3.3
-28								
Particle Density, lb/cu ft	116	113	110	112	115	114	110	116
% Calcine Weight Change	-13.3	-9.1	-8.4	-7.4		-8.4	-9.2	-10.0
Activity	0.20	0.14	0.17	0.17	0.14	0.13	0.10	0.14
Elemental Analysis, Wt %								
SiO_2	9.70	6.03	8.37	9.36		5.79	7.38	7.94
SO_3	0.46	0.28	0.20	0.39		0.77	0.23	0.40
Na_2O	0.14	0.07	0.07	0.06		0.10	0.06	0.12
CaO	82.49	87.01	86.04	83.05		86.97	85.64	85.03
MgO	2.29	2.47	1.70	2.39		1.97	2.03	2.05
K_2O	0.05	0.02	0.03	0.03		0.02	0.03	0.05
Al_2O_3	2.56	2.52	2.24	2.66		2.60	2.69	2.63
Fe_2O_3	1.56	1.25	1.12	1.42		1.20	1.29	1.34
P_2O_5	0.03	0.06	0.05	0.14		0.06	0.13	0.11
TiO_2	0.10	0.10	0.10	0.18		0.20	0.16	0.10

Table 38-15. CIRCULATED ACCEPTOR, RECARBONATED FOR RUN 38C (Sheet 2 of 2)

Date	7/6/76		7/7/76		7/8/76					
Time	1200		2000		0400		1200		2000	
Sample	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor
Screen Size, Wt %										
Tyler Mesh										
+8			6.0		7.7		8.1		8.6	
8 X 9		6.5		30.1		31.1		8.2		34.4
9 X 10	6.7		5.0		6.7		12.2		13.6	
10 X 12		Tr		33.0		30.7		7.5		37.0
12 X 14	30.3	35.5	25.4	9.2	26.5	11.0	25.9	35.8	20.3	5.0
14 X 20	21.3	48.4	14.0	18.0	12.8	18.0	10.5	32.8	9.1	12.5
20 X 28	12.3	3.2	9.8	2.4	8.4	2.6	6.8	5.2	7.6	3.6
28 X 35	12.2		15.0		14.3		12.1		12.4	
35 X 48	8.4		13.6		13.3		12.1		13.0	
48 X 65	4.6	6.5	5.0	5.3	5.8	6.1	.6	9.7	7.3	6.8
65 X 80		Tr		1.0		0.4		0.7		Tr
80 X 100	2.5		2.5		3.0		3.8		4.6	
100 X 200	1.5		1.5		1.1		1.1		2.2	
200 X 325	0.2		1.0		0.1		0.3		0.4	
-325	0.1	Tr	1.0		0.2	Tr	0.3	Tr	0.6	Tr
% Acceptor	28.9		52.7		55.7		54.7		54.8	
% Ash in Char	16.4		10.5		14.0		16.4		15.8	
Ash Elemental Analysis, Wt %										
SiO_2	23.62						37.96			
SO_3	8.62						4.30			
Na_2O	5.00						1.74			

Table 38-16. GASIFIER CHAR BED MATERIAL FOR RUN 38A (Sheet 1 of 2)

Date	← 7/9/76 →						← 7/10/76 →			
Time	0400		1200		2000		0430		1215	
Sample	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor
Screen Size, Wt %										
Tyler Mesh										
+8	10.8		11.3		13.0		11.9		16.6	
8 X 9		23.8		15.1		22.6		18.8		20.6
9 X 10	14.6		14.3		14.4		16.6		21.9	
10 X 12		16.1		14.5		19.0		18.8		19.6
12 X 14	19.5	30.2	18.5	31.6	19.6	29.2	18.4	28.8	17.7	25.8
14 X 20	8.0	19.0	6.3	19.7	5.3	14.6	5.1	17.5	5.0	15.5
20 X 28	8.1	6.3	7.5	6.6	7.8	5.1	7.0	5.0	7.3	6.2
28 X #5	13.2		12.3		10.2		10.7		8.6	
35 X 48	12.7		13.6		43.4		12.9		11.4	
48 X 65	7.2	4.5	8.3	12.5	7.5	9.5	7.9	11.2	5.9	12.4
65 X 80		Tr		Tr		Tr		Tr		Tr
80 X 100	4.4		5.6		5.1		5.6		3.8	
100 X 200	1.5		2.0		2.6		2.8		1.6	
200 X 325	0.1		0.3		0.3		0.5		0.1	
-325	0.1	Tr	0.2	Tr	0.7		0.5	Tr	0.1	Tr
% Acceptor	55.9		56.2		64.2		60.7		63.3	
% Ash in Char	13.1		11.9		11.5		14.8		12.5	
Ash Elemental Analysis, Wt %										
SiO_2			39.82				37.42			
SO_2			4.19				4.19			
Na_2O			1.35				1.40			

Table 38-16. GASIFIER CHAR BED MATERIAL FOR RUN 38A (Sheet 2 of 2)

Date	7/24/76		← 7/25/76 →				7/26/76	
Time	1200		1140		2000		0400	
Sample	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor
Screen Size, Wt %								
Tyler Mesh								
+8	0.1		0.6		0.7		2.6	
8 X 9		Tr		1.7		0.9		3.7
9 X 10	3.1		3.7		3.8		7.1	
10 X 12		28.6		37.5		4.4		7.4
12 X 14	22.2	19.0	28.4	20.0	30.6	31.0	26.6	38.3
14 X 20	21.0	25.4	17.6	23.3	16.9	46.0	11.6	33.3
20 X 28	17.3	6.3	8.8	4.2	8.4	5.3	6.7	3.7
28 X 35	15.0		12.3		9.7		11.4	
35 X 48	11.3		13.9		14.7		15.3	
48 X 65	5.2	20.6	8.2	13.3	8.3	12.4	9.7	12.3
65 X 80		Tr		Tr		Tr		1.2
80 X 100	2.8		4.1		4.6		5.8	
100 X 200	1.6		1.6		1.7		2.2	
200 X 325	0.2		0.4		0.2		0.4	
-325	0.3	Tr	0.3	Tr	0.2	Tr	0.6	Tr
% Acceptor	31.4		58.6		58.8		58.9	
% Ash in Char	16.3		18.0		17.70		17.52	
Ash Elemental Analysis, Wt %								
SiO_2	30.94		41.30					
SO_3	5.23		2.37					
Na_2O	2.44		2.64					
% Junk in Bed	8.45		7.23		10.41		10.13	

Table 38-17. GASIFIER CHAR BED MATERIAL FOR RUN 38B (Sheet 1 of 2)

Date	← 7/26/76 →						7/27/76	
Time	0800		1140		2000		0400	
Sample	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor
Screen Size, Wt %								
Tyler Mesh								
+8	3.0		3.6		6.1		5.9	
8 X 9		6.6		7.2		8.8		12.5
9 X 10	9.1		9.9		15.3		13.3	
10 X 12		9.2		9.7		14.4		16.3
12 X 14	23.0	28.9	24.5	33.3	23.0	33.6	18.2	32.5
14 X 20	10.7	30.3	11.6	28.7	9.2	26.4	8.2	20.0
20 X 28	8.3	5.3	7.5	5.6	6.8	4.8	7.6	6.3
28 X 35	12.4		12.6		9.9		11.7	
35 X 48	16.2		14.6		14.7		15.9	
48 X 65	9.1	19.7	8.5	15.4	7.9	12.0	9.5	12.5
65 X 80		Tr		Tr		Tr		Tr
80 X 100	5.5		4.8		4.8		6.1	
100 X 200	2.0		1.8		1.8		2.7	
200 X 325	0.2		0.2		0.4		0.4	
-325	0.5	Tr	0.4	Tr	Tr	Tr	0.6	Tr
% Acceptor	52.4		63.7		61.6		56.2	
% Ash in Char	15.52		14.77		14.41		13.89	
Ash Elemental Analysis, Wt %								
SiO_2			39.02				36.65	
SO_3			2.84				3.75	
Na_2O			1.42				1.52	
% Junk in Bed	13.10		13.38		10.35		10.57	

Table 38-17. GASIFIER CHAR BED MATERIAL FOR RUN 38B (Sheet 2 of 2)

Date	8/15/76				8/16/76				8/17/76			
Time	1200		2000		1200		2000		0415		1200	
Sample	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor
Screen Size, Wt %												
Tyler Mesh												
+8	0.1		1.8		4.0		7.4		8.0		9.5	
8 X 9		1.8		6.6		14.3		22.8		27.8		46.7
9 X 10	2.0		5.4		11.9		14.6		13.8		15.0	
10 X 12		32.1		30.3		36.2		32.4		27.8		21.7
12 X 14	23.7	20.2	26.8	18.0	31.2	14.3	24.5	13.3	20.1	10.2	19.4	7.5
14 X 20	16.6	24.8	15.3	23.8	12.9	18.1	10.6	14.3	9.5	14.8	9.4	10.8
20 X 28	8.7	5.5	8.0	5.7	5.6	4.8	5.7	5.7	6.4	5.6	6.2	3.3
28 X 35	13.3		12.4		7.9		8.5		10.3		8.7	
35 X 48	18.6		15.6		11.0		12.7		14.7		12.9	
48 X 65	10.0	14.7	8.7	15.6	7.0	12.4	7.5	11.4	9.1	13.9	7.8	10.0
65 X 80		0.1		Tr		Tr		Tr		Tr		Tr
80 X 100	5.2		4.4		4.6		4.8		5.6		5.6	
100 X 200	1.6		1.4		2.5		2.2		1.8		3.2	
200 X 325	0.1		0.1		0.6		0.4		0.3		0.8	
-325	Tr	Tr	0.1	Tr	0.7	Tr	1.1	Tr	0.4	Tr	1.4	Tr
% Acceptor	52.5		58.0		66.4		64.0		59.6		67.3	
% Ash in Char	14.46		16.42		18.67		17.73		14.50		14.17	
Elemental Analysis, Wt %												
SiO_2	36.98				38.53				36.64			
SO_3	1.50				1.99				2.46			
Na_2O	4.38				3.32				2.70			

Table 38-18. GASIFIER CHAR BED MATERIAL FOR RUN 38C (Sheet 1 of 4)

Date	8/17/76		← 8/18/76 →				← 8/20/76 →				8/21/76	
Time	2000		1200		2130		0400		1200		0400	
Sample	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor
Screen Size, Wt % Tyler Mesh												
+8	10.5		7.0		8.9		5.6		9.6		7.8	
8 X 9		30.8		32.2		34.7		25.0		31.3		36.7
9 X 10	17.6		10.0		10.9		8.3		15.9		13.1	
10 X 12		23.1		15.3		16.7		6.3		18.2		20.5
12 X 14	14.8	9.9	9.3	5.1	9.7	2.8	9.5	3.1	12.3	4.0	11.7	5.4
14 X 20	8.0	14.3	4.6	9.3	3.7	8.3	9.8	10.4	7.9	9.1	6.2	9.6
20 X 28	6.4	6.6	6.6	7.6	6.6	6.9	13.9	12.5	10.2	9.1	8.4	8.4
28 X 35	9.3		13.0		12.8		18.6		12.9		14.6	
35 X 48	13.5		22.9		19.8		16.8		14.0		16.7	
48 X 65	8.0	15.4	12.7	30.5	11.1	30.6	8.6	41.7	6.8	27.3	8.7	18.1
65 X 80		Tr		Tr		Tr		1.0		1.0		0.6
80 X 100	5.7		7.9		7.8		4.6		4.4		6.1	
100 X 200	3.3		3.9		4.7		3.2		3.3		4.0	
200 X 325	1.0		0.9		1.6		0.6		1.0		0.9	
-325	1.8	Tr	1.1	Tr	2.3	Tr	0.6	Tr	1.8	Tr	1.8	0.6
% Acceptor	59.1		47.7		51.0		42.8		54.2		61.8	
% Ash in Char	18.35		19.37		25.34		16.39		20.34		12.45	
Elemental Analysis, Wt %												
SiO_2									33.74			
SO_3									3.95			
Na_2O									3.16			

Table 38-18. GASIFIER CHAR BED MATERIAL FOR RUN 38C (Sheet 2 of 4)

Date	← 8/23/76 →						← 8/24/76 →				8/25/76	
Time	0400		1200		2100		0355		0930		0800	
Sample	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor
Screen Size, Wt %												
Tyler Mesh												
+8	8.8		13.1		12.2		9.4		14.9		12.3	
8 X 9		38.8		53.3		49.0		43.8		54.3		48.8
9 X 10	14.2		21.1		18.2		15.4		22.0		20.2	
10 X 12		16.5		16.7		16.7		14.3		16.2		19.0
12 X 14	7.8	0.4	8.6	3.3	7.5	4.2	8.7	3.8	11.1	4.8	8.3	3.3
14 X 20	7.9	0.9	5.7	6.7	4.8	7.3	5.3	8.6	5.5	6.7	5.8	8.3
20 X 28	12.4	0.9	9.1	7.8	8.6	8.3	8.9	10.5	7.7	5.7	7.6	6.6
28 X 35	16.6		13.0		11.7		4.7		8.0		7.9	
35 X 48	14.5		13.1		18.3		27.2		16.1		18.2	
48 X 65	8.6	20.0	7.8	12.2	9.5	14.6	9.8	17.1	7.4	12.4	8.8	14.0
65 X 80		1.2		0		Tr		1.0		Tr		Tr
80 X 100	5.5		5.0		5.7		6.2		4.7		6.0	
100 X 200	2.9		2.4		2.5		3.3		2.0		3.0	
200 X 325	0.4		0.4		0.6		0.7		0.3		0.6	
-325	0.4	1.2	0.5		0.4	Tr	0.4	1.0	0.3	Tr	1.2	Tr
% Acceptor	42.15		56.1		50.0		51.2		61.5		43.9	
% Ash in Char	12.57		14.14		14.11		10.66		11.78		10.47	
Elemental Analysis, Wt %												
SiO_2			34.02						38.37		37.04	
SO_3			3.35						2.85		2.40	
Na_2O			2.05						1.52		1.77	

Table 38-18. GASIFIER CHAR BED MATERIAL FOR RUN 38C (Sheet 3 of 4)

Date	← 8/25/76 →				← 8/26/76 →						8/27/76	
Time	1200		2000		0800		1200		2000		0400	
Sample	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor
Screen Size, Wt % Tyler Mesh												
+8	13.7		14.1		11.0		13.2		19.7		13.3	
8 X 9		42.7		37.2		45.2		41.0		55.4		43.2
9 X 10	20.4		24.5		19.1		19.3		26.2		21.0	
10 X 12		19.5		23.2		18.4		20.0		20.0		17.3
12 X 14	8.9	4.9	8.7	4.6	8.1	3.6	7.7	3.8	10.0	2.3	8.3	3.6
14 X 20	6.2	8.5	5.4	8.1	5.2	7.7	4.2	7.6	5.7	5.4	5.3	7.2
20 X 28	7.9	8.5	7.9	11.6	8.3	8.0	8.2	8.6	7.6	6.2	8.3	9.4
28 X 35	10.6		11.1		13.8		13.8		11.3		13.7	
35 X 48	14.9		13.4		13.8		14.0		9.8		12.8	
48 X 65	8.2	15.8	7.8	15.1	9.6	17.1	9.3	17.1	5.4	10.8	8.1	19.14
65 X 80		Tr		Tr		Tr		1.0		Tr		
80 X 100	5.4		4.9		6.3		6.3		3.1		5.3	
100 X 200	2.8		1.8		3.3		3.4		0.9		2.8	
200 X 325	0.5		0.2		0.6		0.5		0.1		0.5	
-325	0.5	Tr	0.2	Tr	0.8	Tr	Tr	1.0	0.1	Tr	0.4	
% Acceptor	56.5		60.6		51.6		51.5		62.3		53.9	
% Ash in Char	14.15		7.64		13.00		11.90		9.92		13.50	
Elemental Analysis, Wt %												
SiO_2			36.51		36.86		36.95		35.37		37.96	
SO_3			3.17		3.54		3.72		2.62		2.82	
Na_2O			1.87		1.33		1.12		1.18		1.27	

Table 38-18. GASIFIER CHAR BED MATERIAL FOR RUN 38C (Sheet 4 of 4)

Date	7/6/76		7/7/76		7/8/76		7/9/76		7/10/76	
Time	0830	1900	1130	1630	1035	1900	1120	2230	0430	1050
Screen Size, Wt %										
Tyler Mesh										
+4							7.0			3.8
4 X 6		0.1	1.3	5.0	14.8	18.1	26.2	25.1	22.5	28.2
6 X 8	0.9						12.8			17.9
8 X 9	7.4	5.5	17.7	6.4	17.0	22.9	15.6	35.4	36.4	17.9
9 X 10	36.6						19.1			15.4
10 X 12	29.7	68.8	21.4	65.8	48.3	43.3	12.6	31.4	33.0	8.8
12 X 14	18.6						6.2			2.5
14 X 16	6.1	24.6	55.3	20.8	17.1	11.7	2.2	4.8	5.0	1.9
16 X 20	0.7						1.0			1.2
20 X 24	Tr	0.9	2.8	1.5	1.6	2.1	0.7	1.9	1.8	0.7
24 X 28	Tr	0.1	1.5	0.6	1.2	1.9	1.4	1.4	1.3	1.5
-28										
% Calcine Weight Change	-2.2		-0.6		-1.3		-0.4		-0.6	
Elemental Analysis, Wt %										
SiO_2	0.80		3.32		6.12		6.40		6.89	
SO_3	0.34		0.24		0.27		0.87		0.67	
Na_2O	0.05		0.04		0.05		0.07		0.05	
CaO	54.40		54.46		64.95		78.54		75.27	
MgO	42.33		38.36		23.72		10.34		7.84	
K_2O	0.01		0.01		0.02		0.01		0.01	
Al_2O_3	0.03		1.73		2.52		2.58		2.68	
Fe_2O_3	1.13		1.54		1.53		1.11		1.01	
P_2O_5	1.27		0.01		0.03		0.06		0.06	
TiO_2	0.06		0.06		0.11		0.12		0.10	

Table 38-19. PURGED ACCEPTOR FOR RUN 38A

Date	7/24/76	7/25/76	7/26/76	7/27/76
Time	0720	0800	0555	0130
Screen Size, Wt %				
Tyler Mesh				
+4				
4 X 6				
6 X 8	0.4	Tr	3.1	17.1
8 X 9				
9 X 10	5.6	1.4	14.8	34.1
10 X 12				
12 X 14	62.7	61.2	60.5	36.3
14 X 16				
16 X 20	27.6	33.6	17.6	7.8
20 X 24				
24 X 28	3.4		2.9	3.1
-28	0.4	3.8	1.1	1.5
% Calcine Weight Change	-1.5	-0.1	-0.3	-1.4
Elemental Analysis, Wt %				
SiO_2	1.56	5.15	5.88	5.94
SO_3	0.24	0.07	0.25	0.55
Na_2O	0.03	0.06	0.07	0.07
CaO	59.47	57.53	65.11	80.78
MgO	34.23	32.52	24.14	9.35
K_2O	0.02	0.02	0.03	0.03
Al_2O_3	1.48	1.95	1.80	2.13
Fe_2O_3	1.26	1.44	1.31	1.15
P_2O_5	0.01	0.02	0.04	0.06
TiO_2	0.07	0.09	0.12	0.11

Table 38-20. PURGED ACCEPTOR FOR RUN 38B

Date	7/14/76	8/15/76	8/16/76	8/17/76		8/18/76	8/20/76	8/21/76	8/23/76
Time	1900	0700	0825	0430	1200	1710	1220	0940	1640
Screen Size, Wt %									
Tyler Mesh									
+4			0.2	0.1	0.1	0.5	0.1	0.3	0.2
4 X 6			6.6	10.1	12.8	27.6	34.5	32.1	35.8
6 X 8	Tr		13.4	15.7	17.2	22.5	26.5	27.9	28.0
8 X 9	1.7		14.7	11.3	13.1	16.1	16.4	16.6	16.6
9 X 10	2.8	2.9	26.7	23.9	19.5	10.5	8.8	8.2	7.1
10 X 12	39.9		20.2	18.7	17.1	9.7	6.0	4.9	4.0
12 X 14	28.9	64.3	11.5	9.1	8.6	4.5	2.3	2.6	2.4
14 X 16	14.4		4.6	6.0	6.0	4.3	2.8	2.4	2.6
16 X 20	19.7	30.7	0.9	2.2	2.6	2.5	0.9	1.9	1.0
20 X 24	1.4		0.3	1.5	1.5	1.2	0.2	1.0	0.7
24 X 28	0.8	1.8	0.9	1.4	1.5	0.6	1.5	2.1	1.6
-28	0.4	0.3							
% Calcine Weight Change	-0.5	-0.6	-1.0	-1.2	-1.3	-0.8	-27.7	-0.5	-0.7
Elemental Analysis, Wt %									
SiO_2	2.79	5.02	8.20	7.52	10.06	11.90	10.56	10.18	6.67
SO_3	Tr	Tr	0.32	0.40	0.39	0.50	0.65	0.31	0.30
Na_2O	0.11	0.19	0.43	0.22	0.45	0.35	0.24	0.30	0.06
CaO	52.80	54.43	61.99	63.02	70.29	71.81	80.16	79.40	87.42
MgO	41.66	37.05	25.18	22.78	13.89	8.91	3.40	3.64	1.92
K_2O	0.01	0.03	0.06	0.05	0.10	0.09	0.10	0.11	0.02
Al_2O_3	1.22	1.53	1.82	2.41	2.54	2.88	2.53	3.42	2.27
Fe_2O_3	1.29	1.47	1.46	1.34	1.39	1.74	1.80	1.78	1.32
P_2O_5	0.01	0.02	0.05	0.04	0.06	0.05	0.04	0.06	0.03
TiO_2	0.06	0.08	0.11	0.03	0.16	0.17	0.14	0.15	0.07

Table 38-21. PURGED ACCEPTOR FOR RUN 38C (Sheet 1 of 2)

Date	8/24/76		8/25/76		8/26/76		8/27/76	
Time	0820	1610	0000	1800	0910	2315	0520	1015
Screen Size, Wt %								
Tyler Mesh								
+4								
4 X 6	0.3	0.4	0.3	0.3	Tr	0.4	0.3	0.2
6 X 8	29.2	36.7	33.5	29.9	29.2	30.5	36.1	30.8
8 X 9	30.7	25.0	30.5	26.6	30.7	29.8	28.0	31.2
9 X 10	16.2	12.9	16.9	14.9	19.6	16.9	19.0	18.9
10 X 12	9.4	7.5	7.3	9.3	8.6	7.7	7.5	7.9
12 X 14	5.6	5.3	4.6	5.7	5.1	4.4	3.9	4.1
14 X 16	2.5	3.4	1.8	2.9	1.1	2.0	1.4	1.4
16 X 20	1.8	3.0	1.2	2.6	1.9	2.2	1.1	1.6
20 X 24	1.6	1.7	1.4	2.2	1.4	1.6	1.0	1.3
24 X 28	1.2	1.5	1.0	2.2	0.7	1.7	0.8	0.8
-28	1.5	2.6	1.5	3.2	1.8	2.8	0.9	1.9
% Calcine Weight Change	-1.7	-1.6	-0.9	-1.6	-0.6	-0.9		
Elemental Analysis, Wt %								
SiO_2	6.94	6.87	9.00	11.38	5.20	7.38		
SO_3	0.18	0.20	0.23	0.32	0.66	0.18		
Na_2O	0.08	0.06	0.09	0.09	0.03	0.07		
CaO	87.12	87.10	84.75	30.96		85.55		
MgO	1.88	1.86	1.77	2.44		2.16		
K_2O	0.03	0.03	0.03	0.06		0.03		
Al_2O_3	2.45	2.44	2.33	2.99		2.74		
Fe_2O_3	1.20	1.17	1.07	1.34		1.38		
P_2O_5	0.05	0.05	0.04	0.14		0.11		
TiO_2	0.09	0.09	0.08	0.11		0.14		

Table 38-21. PURGED ACCEPTOR FOR RUN 38C (Sheet 2 of 2)

Date	7/7/76	7/8/76	7/9/76	7/10/76
Time	0630	0230	0600	0500
Screen Size, Wt %				
Tyler Mesh				
+35	2.0	-	0.2	0.2
35 X 48	1.7	0.9	0.2	0.2
48 X 65	4.4	2.1	1.0	1.2
65 X 100	12.5	7.5	8.3	8.6
100 X 200	31.8	20.1	32.1	28.8
200 X 325	44.4	15.8	12.5	16.1
-325	4.0	53.7	45.7	44.8
Ultimate Analyses, Wt %				
C	46.4	62.6	59.6	63.4
H	0.9	1.10	1.00	0.9
N	0.26	0.31	0.23	
S	0.77	0.79	0.78	0.58
Ash + SO_3	52.18	32.48	36.78	29.49
Elemental Analyses, Wt %				
SiO_2	26.00	33.60	33.22	35.68
SO_3	4.71	5.70	5.14	5.50
Na_2O	4.27	0.96	1.21	0.91
CaO	35.12	34.03	35.08	33.60
MgO	7.43	3.21	3.21	3.47
K_2O	0.35	0.35	0.34	0.29
Al_2O_3	14.59	15.58	16.04	15.54
Fe_2O_3	7.05	5.36	4.51	4.59
P_2O_5	0.14	0.37	0.42	0.30
TiO_2	0.55	0.69	0.74	0.77

Table 38-22. GASIFIER CYCLONE CHAR FOR RUN 38A

Date	7/25/76	7/25/76	7/26/76	7/26/76
Time	1125	1645	1020	1900
Screen Size, Wt %				
Tyler Mesh				
+35	1.5	0.7	0.4	0.5
35 X 48	0.6	1.1	0.4	0.5
48 X 65	2.6	4.8	2.8	2.2
65 X 100	12.0	21.0	15.8	11.9
100 X 200	35.8	34.0	30.2	31.8
200 X 325	20.4	25.7	17.8	14.3
-325	27.1	12.6	32.6	38.8
Ultimate Analysis, Wt %				
C		57.6		63.4
H		1.2		1.0
N		0.34		0.31
S		0.49		0.52
Ash + SO_3		35.88		30.65
Elemental Analysis, Wt %				
SiO_2		38.55		31.42
SO_3		3.21		3.88
Na_2O		3.29		0.85
CaO		23.75		37.07
MgO		6.92		4.33
K_2O		0.60		0.32
Al_2O_3		16.31		14.92
Fe_2O_3		6.67		5.22
P_2O_5		0.22		0.54
TiO_2		0.55		0.73

Table 38-23. GASIFIER CYCLONE CHAR FOR RUN 38B

Date	8/15/76		8/16/76	← 8/17/76 →			← 8/18/76 →			← 8/20/76 →		
Time	0300	2000	1900	0343	1300	1730	0800	1415	2100	0400	1000	1730
Screen Size, Wt %												
Tyler Mesh												
+20												
20 X 35	0.1	0.3	0.5	0.1	0	0.6	Tr	0.4	1.4	0	0.1	1.2
35 X 48	0.2	0.3	0.9	0.3	1.2	0.7	0.3	0.7	1.4	0.1	0.4	1.8
48 X 65	1.7	3.1	4.2	3.4	3.9	3.0	3.0	3.0	5.7	0.9	2.1	7.1
65 X 100	10.8	20.2	19.8	20.5	16.0	16.2	19.2	15.1	27.0	9.6	13.3	16.7
100 X 200	29.3	37.3	30.8	34.7	26.4	32.0	34.4	27.9	34.8	37.4	31.4	26.2
200 X 325	35.8	16.5	19.3	20.7	17.4	19.6	20.3	10.9	17.7	32.3	20.0	36.9
-325	22.2	22.4	24.5	20.2	35.1	28.0	22.8	41.9	12.1	19.6	33.0	10.1
Ultimate Analysis, Wt %												
Moisture		7.48	0.55	0.36				0.56			0.46	
C		63.35	68.56	67.11				66.42			60.62	
H		1.65	1.02	0.93				0.93			0.90	
N		0.34	0.23	0.24				0.30				
Total S		0.29	0.29	0.30				0.27			0.29	
Ash + SO_3		27.84	27.78	27.47				29.33			34.98	
Elemental Analysis, Wt %												
SiO_2		30.84	30.46	31.75				28.92			30.10	
SO_3		1.67	2.64	1.96				1.65			2.13	
Na_2O		3.22	1.99	1.91				1.75			0.61	
CaO		36.52	39.20	38.12				42.70			38.28	
MgO		6.07	5.31	5.96				6.12			5.14	
K_2O		0.36	0.36	0.34				0.33			0.38	
Al_2O_3		15.61	14.76	14.70				13.04			14.66	
Fe_2O_3		5.05	4.32	4.53				5.14			8.40	
P_2O_5		0.16	0.16	0.12				0.11			0.32	
TiO_2		0.53	0.49	0.48				0.33			0.50	

Table 38-24. GASIFIER CYCLONE CHAR FOR RUN 38C (Sheet 1 of 2)

Date	8/21/76	8/23/76	← 8/24/76 →			8/25/76	← 8/26/76 →			8/27/76	
Time	0730	0730	0240	0730	1715	1800	0245	0915	1845	0315	1000
Screen Size, Wt %											
Tyler Mesh											
+20											
20 X 35	0.9	Tr	0.2	0.2	0	0.4	0.7	0	0	0.3	0.4
35 X 48	1.3	0.1	0.7	0.7	0.8	1.2	1.4	0.7	0.3	0.4	0.8
48 X 65	2.8	0.6	3.3	3.6	2.9	3.4	2.9	2.5	2.1	3.5	3.5
65 X 100	14.7	6.3	15.3	20.5	12.3	14.3	12.7	11.3	12.5	21.5	14.6
100 X 200	28.4	39.1	26.9	28.2	22.9	27.2	28.3	23.0	25.5	37.5	26.8
200 X 325	15.6	20.8	14.3	8.6	9.2	10.9	9.0	9.9	9.9	10.6	14.2
-325	36.5	33.0	39.2	38.1	51.9	42.5	44.9	52.5	47.7	26.2	39.8
Ultimate Analysis, Wt %											
Moisture	0.27	0.56		0.11	0.37	0.16	0.25	0.36	0.23	0.94	
C	66.89	57.69		68.34	66.93	71.17	69.62	68.91	69.29	71.99	
H	1.11	0.86		0.94	0.89	1.17	1.03	1.01	0.91	0.11	
N				0.30		0.32				0.33	
Total S	0.22	0.73		0.25	0.22	0.20	0.25	0.28	0.29	0.20	
Ash + SO_3	28.34	35.64		28.96	28.51	25.60	25.89	25.90	26.63	23.55	
Elemental Analysis, Wt %											
SiO_2	31.02	35.34		33.58	33.52	37.34	36.64	34.47	36.48	35.46	
SO_3	1.77	3.36		2.10	1.78	1.74	2.32	2.65	2.71	2.06	
Na_2O	0.81	1.20		0.73	0.72	0.73	0.75	0.74	0.72	0.87	
CaO	37.88	33.03		39.85	39.58	34.14	34.54	36.83	36.17	36.02	
MgO	5.31	7.29		6.48	4.44	5.32	4.20	4.39	3.89	4.27	
K_2O	0.43	0.44		0.38	0.34	0.33	0.37	0.33	0.36	0.39	
Al_2O_3	15.99	12.84		13.25	13.03	14.37	14.80	14.65	14.41	14.91	
Fe_2O_3	5.66	6.14		5.20	5.34	4.68	4.60	4.56	4.24	4.91	
P_2O_5	0.31	0.23		0.40	0.42	0.48	0.56	0.42	0.55	0.60	
TiO_2	0.62	0.63		0.74	0.65	0.71	0.63	0.69	0.76	0.70	

Table 38-24. GASIFIER CYCLONE CHAR FOR RUN 38C (Sheet 2 of 2)

Date	← 7/7/76 →		← 7/8/76 →		← 7/9/76 →	
Cyclone	Primary	Secondary	Primary	Secondary	Primary	Secondary
Screen Size, Wt %						
Tyler Mesh						
+35	2.8	0.7	5.2	0.5	3.1	0.1
35 X 48	3.8	0.8	6.0	1.2	6.0	0.7
48 X 65	5.1	1.4	8.4	1.8	9.2	1.3
65 X 100	10.1	2.1	10.9	2.7	12.4	1.7
100 X 200	23.9	5.7	18.2	6.4	21.4	4.1
200 X 325	13.4	12.7	10.5	4.4	20.5	5.4
-325	40.9	76.6	40.8	82.9	27.4	86.6
% Calcine Weight Change	-15.8	-5.1	-8.0	-7.0	-7.4	-5.9
Sulfide	0.66	1.22		1.55		1.76
Ultimate Analyses, Wt %						
C	17.0	8.5	12.4	10.5	12.4	12.0
H	0.6	0.4	0.2	0.4	0.2	0.4
N	0.08	0.04		0.06		0.05
S	1.32	1.94	1.91	2.15	1.24	2.36
Ash + SO_3	80.90	90.09	87.18	87.67	89.50	88.20
Elemental Analyses, Wt %						
SiO_2	28.46	21.71	28.96	22.28	31.36	30.48
SO_3	4.52	6.00	6.96	6.66	6.02	10.23
Na_2O	2.14	1.96	1.98	2.14	1.25	1.52
CaO	40.56	43.83	43.51	43.91	45.18	44.11
MgO	5.73	6.54	2.49	4.49	2.53	3.33
K_2O	0.36	0.38	0.31	0.39	0.34	0.43
Al_2O_3	12.82	13.91	12.25	14.18	10.04	15.07
Fe_2O_3	4.19	4.41	2.57	3.56	2.44	3.09
P_2O_5	0.25	0.36	0.34	0.39	0.34	0.46
TiO_2	0.68	0.75	0.68	0.81	0.53	0.86

Table 38-25. ASH AND ATTRITED ACCEPTOR COMPOSITES FOR RUN 38A

Date	7/25/76	7/26/76	7/26/76	7/26/76
Time	1800	0500	1800	2200
Cyclone	Secondary	Primary	Secondary	
Screen Size, Wt %				
Tyler Mesh				
+35	2.2	3.8	1.8	2.9
35 X 48	5.8	6.4	4.3	5.3
48 X 65	8.2	9.8	6.2	9.4
65 X 100	10.8	12.3	8.4	12.3
100 X 200	18.1	20.2	15.3	20.7
200 X 325	18.3	12.6	15.4	15.7
-325	36.8	34.0	48.7	38.5
% Calcine Weight Change	-10.8		-6.9	-7.6
Sulfide	0.70		1.18	1.09
Ultimate Analysis, Wt %				
C	13.6		9.4	9.2
H	0.4		0.2	0.3
N	0.08		0.04	0.05
S	0.96		1.23	1.01
Ash + SO_3	86.78		90.05	89.88
Elemental Analysis, Wt %				
SiO_2	30.16		30.91	32.60
SO_3	8.03		5.61	4.82
Na_2O	0.61		1.36	1.41
CaO	42.15		43.12	43.88
MgO	4.25		3.37	3.15
K_2O	0.40		0.50	0.58
Al_2O_3	0.28		11.26	10.61
Fe_2O_3	10.47		2.71	2.56
P_2O_5	3.02		0.28	0.29
TiO_2	0.58		0.61	0.60

Table 38-26. ASH AND ATTRITED ACCEPTOR COMPOSITES FOR RUN 38B

Date	8/16/76	8/17/76	8/18/76	8/19/76		8/20/76		8/21/76	8/23/76		8/24/76		8/25/76	8/26/76
P/S Cyclone*	P	P	P	S	P	S	P	P	S	P	S	P	P	P
Screen Size, Wt %														
Tyler Mesh														
+20														
20 X 35	1.4	2.8	4.2	2.2	1.1	0.2	3.5	10.9	0.2	4.0	0.1	8.5	4.7	10.0
35 X 48	7.7	5.9	3.4	0.5	4.5	0.2	9.1	9.5	0.4	8.5	0.4	10.8	7.9	8.9
48 X 65	13.6	9.8	6.3	0.7	9.3	0.4	13.1	11.9	0.5	11.1	0.5	10.4	9.0	10.0
65 X 100	16.7	13.2	9.5	1.0	13.5	0.6	15.6	13.3	0.8	14.2	4.4	14.5	11.2	12.0
100 X 200	22.7	21.9	17.0	2.6	26.2	2.3	22.5	18.8	2.0	21.0	4.5	20.7	19.3	19.0
200 X 325	14.0	15.0	10.8	3.7	17.7	3.2	10.1	9.4	2.4	10.1	1.8	9.7	12.6	13.3
-325	23.9	31.4	48.8	88.8	27.7	93.1	26.1	26.2	93.8	31.1	88.3	25.4	35.3	26.8
Ultimate Analysis, Wt %														
C	8.14	6.26	6.44	6.54	7.92	6.28	7.32	5.15	5.10	5.7	3.8	8.1	13.1	12.1
H	0.30	0.31	0.29	0.86	0.23	0.51	0.26	0.25	0.20	0.1	0.20	0.2	0.2	0.2
N	0.05								0.10	0.2	0.20	0.3	0.1	0.1
Total S	0.89	0.66	2.06	1.18	1.35	2.14	1.28	0.91	0.98	1.43	3.55	2.44	1.61	2.28
Ash + SO_3														
Elemental Analysis, Wt %														
SiO_2	26.17	22.53	24.71	20.10	21.61	19.86	24.69	26.85	24.04	26.65	20.54	30.45	34.04	33.61
SO_3	2.42	4.36	5.32	3.35	3.68	5.93	3.36	2.43	2.75	3.70	5.74	2.07	2.08	3.79
Na_2O	3.42	7.17	3.96	0.88	1.32	2.39	5.04	3.08	2.05	1.80	2.16	1.06	0.92	0.75
CaO	50.84	49.70	51.87	60.46	56.47	47.22	53.82	53.23	39.21	50.14	50.67	51.14	47.22	48.29
MgO	3.28	3.15	3.23	3.81	4.58	6.66	3.28	3.06	9.00	3.97	5.39	3.62	3.61	3.00
K_2O	0.51	0.36	0.39	0.23	0.26	0.49	0.42	0.37	0.81	0.56	0.56	0.32	0.26	0.25
Al_2O_3	10.75	9.15	7.58	7.64	7.47	11.13	5.99	6.90	14.83	9.71	11.96	8.81	8.62	8.20
Fe_2O_3	2.57	2.35	2.54	3.45	3.39	4.69	2.80	2.90	6.72	2.91	3.40	2.01	2.15	1.84
P_2O_5	0.37	0.33	0.27	0.09	0.13	0.14	0.11	0.13	0.16	0.16	0.30	0.31	0.48	0.30
TiO_2	0.41	0.27	0.37	0.21	0.26	0.48	0.25	0.21	0.28	0.25	0.42	0.30	0.30	0.40

*NOTE: P = Primary S = Secondary Cyclone

Table 38-27. ASH AND ATTRITED ACCEPTOR COMPOSITES FOR RUN 38C

Date	7/7/76	7/8/76	7/9/76
Screen Size, Wt %			
Tyler Mesh			
+35	0.6	0.6	0
34 X 48	0.6	0.6	Tr
48 X 65	5.8	0.8	Tr
65 X 100	15.9	1.7	6.0
100 X 200	35.3	38.4	44.2
200 X 325	34.4	52.6	45.2
-325	7.5	5.3	4.3
Ultimate Analyses, Wt %			
C	62.9	63.0	67.0
H	1.10	1.20	1.40
N	0.29	0.26	
S	0.71	0.53	0.53
Ash + SO_3	28.18	27.52	25.47
Elemental Analyses, Wt %			
SiO_2	30.96	31.64	27.99
SO_3	5.91	4.96	5.69
Na_2O	1.11	1.04	1.01
CaO	36.32	38.58	36.95
MgO	3.20	2.64	2.84
K_2O	0.36	0.31	0.30
Al_2O_3	18.67	17.34	17.26
Fe_2O_3	1.66	1.76	5.19
P_2O_5	0.77	0.66	0.55
TiO_2	1.00	0.82	0.87

Table 38-28. GASIFIER QUENCH TOWER SOLIDS FOR RUN 38A

Date	7/25/76	7/26/76
Screen Size, Wt %		
Tyler Mesh		
+35	0.6	0.7
35 X 48	0.7	0.9
48 X 65	6.9	3.1
65 X 100	32.2	20.2
100 X 200	38.8	36.2
200 X 325	21.0	33.8
-325	8.8	5.2
Ultimate Analysis, Wt %		
C	70.7	64.8
H	1.0	0.7
N	0.36	0.33
S	0.52	0.68
Ash + SO_3	24.57	29.01
Elemental Analysis, Wt %		
SiO_2	34.66	32.10
SO_3	4.84	4.63
Na_2O	1.27	1.44
CaO	28.70	32.32
MgO	3.71	3.10
K_2O	0.34	0.29
Al_2O_3	18.44	17.88
Fe_2O_3	6.57	6.76
P_2O_5	0.65	0.60
TiO_2	0.82	0.71

Table 38-29. GASIFIER QUENCH TOWER SOLIDS FOR RUN 38B

Date	8/15/76	8/16/76	8/17/76	8/18/76	8/20/76	8/23/76	8/24/76	8/25/76	8/26/76	8/27/76
Ultimate Analysis, Wt %										
C	56.86	64.90	68.84	69.14	60.23	66.48	71.09	71.14	71.07	71.68
H	1.08	1.00	1.10	1.11	1.40	0.89	1.53	1.19	1.14	1.16
N	-	0.30	0.35	-	0.33	0.38	0.32	0.27	0.32	0.30
Total S	0.81	0.87	0.67	0.76	0.75	1.00	0.55	0.35	0.43	0.44
Ash + SO_3	29.19	28.09	21.96	21.92	30.06	34.53	24.66	24.97	26.02	20.91
Elemental Analysis, Wt %										
SiO_2	33.70	28.45	31.70	28.73	28.91	36.22	30.62	30.02	31.60	32.04
SO_3	6.33	6.06	6.36	7.35	5.60	5.86	4.80	3.41	3.86	4.46
Na_2O	3.35	1.47	1.00	0.70	0.83	1.82	1.15	1.15	1.04	1.20
CaO	26.51	36.65	36.61	38.60	38.21	28.18	36.09	40.04	38.32	34.28
MgO	3.45	3.62	3.38	3.56	4.95	2.92	4.08	3.81	3.40	3.57
K_2O	0.24	0.19	0.18	0.16	0.29	0.31	0.25	0.21	0.24	0.27
Al_2O_3	16.01	16.49	14.65	15.16	14.97	15.86	15.99	15.06	15.09	16.39
Fe_2O_3	6.94	5.30	5.04	5.13	5.66	7.96	5.24	5.20	4.60	3.08
P_2O_5	0.55	0.74	0.67	0.69	0.56	0.54	1.09	0.99	0.99	1.45
TiO_2	0.61	0.55	0.44	0.53	0.64	0.80	0.77	0.67	0.72	0.73

Table 38-30. GASIFIER QUENCH TOWER SOLIDS FOR RUN 38C

		Temperature, ^{o}F
Gasifier		
Coal Feed	TE-2215/2216	365
Boot Flow	TE-2040	1440
Side Flow	TE-2057	1500
Regenerator		
Air Inlet	TE-2026	840
Acceptor Lift Gas	TE-2013	1350
Char Lift Gas	TE-2041	780

Table 38-31. AVERAGE PREHEAT TEMPERATURES FOR RUN 38C

Date				8/15/76	← 8/16/76 →			← 8/17/76 →			8/18/76	8/23/76	
Time				2110	0315	0835	2007	0335	1100	1910	0300	0255	1100
dPR*	Chart	Zero	Range In. W.C.										
2030	-10/10	9.0	554.0	4	4.1	4.0	1	0.8	0.5	0.5	0.5	+1.4	+1.2
2089	0/100	4.2	25	43	12	26	10	60	28	25	14	52	10
2088	0/100	3.0	168.7	33	32	44	37	36	38	35	36	32	32
2087	0/100	3.0	43.7	71	70	72	78	74	80	74	77	68	71
2094	0/100	3.0	53.9	61	59	61	69	64	72	65	69	63	67
2093	0/100	3.0	115.4	35.5	35	36	40	38	40.5	37.5	39.5	34.5	37
2001	0/100	3.0	126.2	20	20	21	23	22	24	22	23	19	22
2002	0/100	3.0	57.1	44	41	39	38	35	35	35	34	34	33
2083	0/100	3.0	57.7	61	56	53	49	47	46	44	43	43	41
2019	0/100	4.2	300.0	28	25	16	32	23	25	23	20	12	22
2037	-10/10	9.0	100.0	-1.3	-1.2	-1.4	-1.4	-1.2	-1.2	-1.3	-1.3	-3.6	-2.0
2021	0/100	4.2	50.0	80	83	82	78	68	70	69	70	43	53
2022	0/100	4.8	25.0	48	53	55	52	45	49	47	48	26	33
2073	0/100	3.0	150.0	41	37	34	31	29	28	26	25	23	23
2074	0/100	3.0	180.0	62	54	50	45	45	44	40	40	40	40
2075	0/100	3.0	180.0	69	63	59	54	50	51	47	46	41	44
2076	0/100	3.0	144.0	52	45	42	38	36	36	33	32	28	32
2077	0/100	3.0	144.0	36	28	23	24	18	21	18	17	10	20
2024	0/100	4.2	98.6	45	44	43	23	20	18	29	18	30	26
2025	0/100	4.2	300.0	33	34	33	14	13	11	9	10	14	8
2026	-10/10	9.0	40.0	-2.7	-2.8	-2.6	-2.7	-2.8	-2.7	-2.7	-2.8	-2.3	-2.4
2102	0/100	4.2	100.0	41	35	30	42	53	51	50	51	31	33
2020	0/100	4.2	300.0	67	65	58	76	66	70	64	63	55	69
2036	-10/10	9.0	20.0	-0.6	-0.4	-0.6	-0.8	-0.6	-0.8	-0.8	-0.6	-0.3	-0.3
2028	0/100	4.8	50.0	59	61	62	62	70	58	63	64	57	66
2080	-2/2	9.0	40.0	60	63	64	63	68	63	63	64	63	67

Location*	Pressure, In. W.C.**									
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	65.89	54.48	74.81	59.15	71.60	65.85	60.55	61.13	62.49	53.46
3	179.19	165.65	188.91	183.91	190.49	194.87	178.51	185.33	172.99	169.04
4	271.31	252.94	274.22	267.68	270.73	276.99	256.33	263.37	245.67	242.86
5	330.74	302.78	295.03	338.83	313.88	326.41	299.16	296.72	253.63	282.00
6	323.78	296.36	287.61	331.46	307.50	320.04	292.29	289.85	234.60	271.57
7	272.38	242.52	233.57	279.09	262.11	272.62	245.61	242.53	205.28	235.25
8	213.99	189.78	184.82	233.85	220.20	232.01	207.59	205.98	171.56	201.00
9	-100.20	-98.84	-92.33	-21.45	-16.53	-9.07	-13.09	-6.26	-28.85	-8.41
10	-153.53	-142.08	-129.22	-60.39	-45.17	-42.86	-42.21	-33.21	-45.57	-40.01
11	5.78	5.38	4.84	4.94	5.32	5.02	5.03	5.35	4.31	4.57
12	101.21	84.15	99.97	96.06	118.41	110.90	104.92	106.37	88.87	82.15
13	256.46	233.66	230.48	279.62	271.79	275.95	253.94	252.38	212.33	247.69
14	253.67	231.81	227.63	275.83	268.98	272.19	250.17	249.55	210.91	246.25
15	217.92	195.00	190.46	238.98	227.52	237.18	212.74	211.56	176.71	207.75

*Refer to Figure 1.
**Static pressure at Location 1 is 150 psig.
Pressures given are differential pressures from Location 1.

Table 38-32. PRESSURE BALANCE DATA FOR RUN 38C (Sheet 1 of 3)

Date				8/23/76	← 8/24/76 →					← 8/25/76 →			
Time				2110	0215	1330	1605	1930	2300	0045	0430	0620	1010
dPR*	Chart	Zero	Range In. W.C.										
2030	-10/10	9.0	554.0	1.9	+1.2	+0.8	+0.9	+0.8	+0.9	-	0.6	0.6	1.2
2089	0/100	4.2	25	0+	32	42	38	24	22	10	10	22	58
2088	0/100	3.0	168.7	24	34	35	35	35	34	33	33	34	37
2087	0/100	3.0	43.7	66	73	74	74	74	76	75	73	73	74
2094	0/100	3.0	53.9	61	67	70	70	70	71	69	68	68	69
2093	0/100	3.0	115.4	33.5	37	38	38	38	38	38.5	37.5	37.5	38.5
2001	0/100	3.0	126.2	19.5	21	22	21	22	22	21	21	21	21
2002	0/100	3.0	57.1	33	33	32	32	32	32	31	31	32	30
2083	0/100	3.0	57.7	41	41	41	41	41	41	41	39	38	40
2019	0/100	4.2	300.0	24	19	22	21	23	20	23	21	18	18
2037	-10/10	9.0	100.0	-2.2	-2.2	-1.6	-1.6	-0.8	-0.8	-0.7	-0.7	-0.7	-0.8
2021	0/100	4.2	50.0	70	68	75	75	76	73	72	74	73	73
2022	0/100	4.8	25.0	40	40	47	45	48	42	43	46	45	47
2073	0/100	3.0	150.0	24	24	24	24	24	24	24	24	24	24
2074	0/100	3.0	180.0	39	39	38	38	38	39	39	37	38	41
2075	0/100	3.0	180.0	46	43	45	45	46	46	45	44	42	43
2076	0/100	3.0	144.0	31	28	30	32	33	32	31	31	30	29
2077	0/100	3.0	144.0	19	14	13	19	20	18	16	12	11	10
2024	0/100	4.2	98.6	36	29	27	28	28	28	25	25	25	26
2025	0/100	4.2	300.0	18	12	12	12	10	11	10	10	11	10
2026	-10/10	9.0	40.0	-2.3	-2.3	-2.3	-2.3	-2.4	-2.3	-2.3	-2.3	-2.3	-2.2
2102	0/100	4.2	100.0	53	57	47	49	50	52	50	51	51	35
2020	0/100	4.2	300.0	58	56	65	65	64	64	67	64	60	65
2036	-10/10	9.0	20.0	-0.4	-0.7	-1.2	-1.3	-1.2	-1.3	-1.2	-1.5	-1.4	-1.4
2028	0/100	4.8	50.0	69	74	77	78	79	78	77	76	73	79
2080	-2/2	9.0	40.0	67	70	69	70	70	71	70	69	67	66

Location*	Pressure, In. W.C.**									
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	37.66	59.30	60.90	61.16	60.52	58.15	53.48	54.41	58.28	70.40
3	144.31	175.69	180.88	182.07	178.02	179.30	173.83	172.74	176.75	190.03
4	215.46	248.13	254.19	254.62	249.81	252.42	245.15	243.24	247.34	260.00
5	261.24	277.86	293.38	290.95	291.25	285.26	287.42	279.46	274.15	286.58
6	249.67	266.40	285.03	282.54	287.16	281.09	283.77	275.79	270.48	282.42
7	204.05	221.19	234.86	233.28	235.12	232.96	235.95	226.62	222.10	233.04
8	168.71	185.47	199.21	197.94	198.67	197.22	200.26	191.15	186.69	197.27
9	-45.07	-21.74	-19.34	-20.54	-15.63	-18.51	-13.04	-13.26	-15.93	-14.01
10	-75.73	-45.15	-41.82	-52.22	-47.74	-47.69	-39.27	-32.99	-34.29	-31.03
11	4.28	4.19	4.05	4.12	4.49	4.28	4.25	4.33	4.29	4.04
12	85.05	111.08	102.99	104.78	106.51	105.15	98.49	100.09	103.90	101.11
13	217.76	239.44	256.85	247.34	260.90	256.56	258.26	250.34	242.55	255.51
14	215.86	236.08	251.11	251.18	255.03	250.33	252.52	242.73	235.90	248.79
15	175.53	193.47	206.81	206.02	210.61	205.63	208.27	198.78	193.49	203.60

*Refer to Figure 1.
**Static pressure at Location 1 is 150 psig.
Pressures given are differential pressures from Location 1.

Table 38-32. PRESSURE BALANCE DATA FOR RUN 38C (Sheet 2 of 3)

Date				← 8/25/76 →			← 8/26/76 →						8/27/76
Time				1400	1800	2105	0400	0610	1055	1345	1710	2200	0330
dPR*	Chart	Zero	Range In. W.C.										
2030	-10/10	9.0	554.0	0.6	+0.6	+0.7	0.5	0.5	0.5	0.6	+0.5	+0.5	+0.5
2089	0/100	4.2	25	37	5	1	46	33	12	41	30	18	19
2088	0/100	3.0	168.7	37	35	34	34	34	32	34	35	35	33
2087	0/100	3.0	43.7	77	82	81	72	73	72	75	76	75	74
2094	0/100	3.0	53.9	75	78	75	68	68	68	70	71	71	68
2093	0/100	3.0	115.4	40	41	41	37.5	37.5	37.5	38.5	38.5	38.5	37.5
2001	0/100	3.0	126.2	23	24	23	21	21	21	22	22	22	21
2002	0/100	3.0	57.1	30	40	40	30	30	30	30	30	30	30
2083	0/100	3.0	57.7	41	42	42	41	40.5	40	40	41	41	41.5
2019	0/100	4.2	300.0	19	20	23	23	25	26	20	22	25	25
2037	-10/10	9.0	100.0	-0.8	-0.9	-0.8	-0.8	-0.8	-0.8	-0.7	-0.8	-1.0	-0.6
2021	0/100	4.2	50.0	77	70	68	69	68	65	70	70	69	68
2022	0/100	4.8	25.0	48	42	42	40	39	40	42	43	40	40
2073	0/100	3.0	150.0	25	25	24	24	24	24	24	24	24	24
2074	0/100	3.0	180.0	38	40	39	40	39	42	40	38	38	39
2075	0/100	3.0	180.0	46	48	46	46	46	44	43	47	46	46
2076	0/100	3.0	144.0	31	32	32	32	32	31	31	32	32	31
2077	0/100	3.0	144.0	16	22	21	21	22	20	18	22	19	16
2024	0/100	4.2	98.6	25	26	26	24	24	24	25	25	26	26
2025	0/100	4.2	300.0	8	9	8	7	7	9	9	8	7	7
2026	-10/10	9.0	40.0	-2.4	-2.4	-2.3	-2.3	-2.3	-2.2	-2.2	-2.5	-2.3	-2.3
2102	0/100	4.2	100.0	40	40	42	41	41	39	38	40	40	41
2020	0/100	4.2	300.0	72	75	72	70	72	72	69	74	75	71
2036	-10/10	9.0	20.0	-1.4	-1.4	-1.5	-1.6	-1.4	-1.4	-1.6	-1.4	-1.5	-1.5
2028	0/100	4.8	50.0	75	88	77	81	82	75	80	82	80	80
2080	-2/2	9.0	40.0	71	69	67	68	67	68	67	68	68	70
Location*				Pressure, In. W.C.**									
1				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2				64.79	56.21	52.77	65.21	60.76	52.80	62.14	60.68	57.05	56.53
3				194.28	188.36	180.76	182.21	178.11	169.24	182.94	184.27	179.02	173.25
4				269.41	263.94	253.87	252.80	248.34	238.90	254.32	257.29	251.36	243.44
5				299.89	296.97	295.66	294.99	296.74	290.22	287.18	296.96	300.09	291.39
6				295.62	292.26	291.54	290.83	292.58	286.07	283.54	292.73	294.85	288.30
7				245.55	245.83	245.27	245.05	247.47	242.00	236.86	246.53	249.36	242.51
8				209.40	208.87	209.14	209.29	211.67	206.05	201.14	211.39	213.83	206.36
9				-7.18	-11.10	-8.34	-3.97	-3.89	-9.66	-10.44	-7.06	-5.46	-5.69
10				-33.81	-46.20	-42.42	-37.09	-39.21	-41.87	-39.80	-42.86	-36.98	-31.53
11				4.36	4.50	4.24	4.38	4.28	4.10	4.06	4.58	4.15	4.33
12				99.26	91.46	90.57	101.67	97.25	87.49	95.67	95.56	92.30	93.37
13				268.81	273.37	266.86	270.39	271.89	262.86	261.34	272.77	274.21	266.83
14				262.28	266.70	259.59	262.72	265.17	256.12	253.67	266.17	267.07	259.56
15				218.02	216.49	215.82	216.45	218.41	213.18	207.89	218.65	221.03	214.27

*Refer to Figure 1.
**Static pressure at Location 1 is 150 psig.
Pressures given are differential pressures from Location 1.

Table 38-32. PRESSURE BALANCE DATA FOR RUN 38C (Sheet 3 of 3)

Date	8/22/76	
Time	0155	0315
Screen Size, Wt % Tyler Mesh		
4		
6		
8	22.8	28.0
9		
10	33.4	32.9
12		
14	21.0	18.4
16		
20	10.8	9.9
24		
28	9.3	7.4
-28	2.8	3.5

Table 38-33. ACCEPTOR SCREEN ANALYSIS FOR RUN 38C DURING AGED ACCEPTOR CIRCULATION TESTS

RUN 39

SEPTEMBER 17 TO OCTOBER 5, 1976

CO_2 ACCEPTOR PROCESS GASIFICATION

PILOT PLANT

RAPID CITY, SOUTH DAKOTA

1 SUMMARY

Run 39 was very successful in demonstrating the adaptability of the CO_2 Acceptor Process to medium sodium lignite feedstocks. This, the last of a series of runs featuring Glenharold lignite, was the second most successful demonstration of the process so far. The trouble-free startup procedure demonstrated by Run 36 was again easily executed. Run 39 further confirmed the workability of a process solution to agglomeration problems which plagued previous Glenharold runs.

Glenharold lignite was continuously gasified for approximately 7 days with the entire gasifier heat duty supplied by circulating limestone acceptor. This precluded the need for air in the gasifier. The run lasted long enough to produce two relatively steady-state periods of operation from which heat and material balances for the gasification section can be calculated.

Severe leaks in the regenerator flue gas ash cyclones necessitated an early shutdown.

2 TEST DATA

Run 39 data are presented graphically and/or tabularly at the end of this run report. These figures and tables include:

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3 SIGNIFICANT EVENTS

3.1 TABULAR HISTORY OF RUN 39

3.1.1 Objectives

(1) To demonstrate plant operability using a medium to high sodium content lignite like that found in the Northern Great Plains region of the United States.

(2) To evaluate the effects of operation at reduced steam partial pressures in the gasifier boot.

(3) To achieve an integrated steady-state operation for 2 days, followed by a voluntary shutdown.

(4) To methanate the synthesis gas.

3.1.2 Accomplishments

(1) Run 39 clearly demonstrated the applicability of the CO_2 Acceptor Process for the gasification of medium to high sodium content lignite.

(2) Operation at limited boot steam partial pressure was shown to be an effective means of eliminating the boot acceptor agglomeration which occured in Run 36.

(3) The run was sufficiently long to achieve:

(a) Eight days of integrated plant operation.

(b) Almost 7 days (165 hours) of feeding Glenharold lignite without the use of air as a gasifier heat source.

(c) Two days of methanator operation.

(4) The capability of controlling the gasifier char bed density was successfully demonstrated.

3.1.6 Termination Causes

Leaks caused by erosion in the regenerator external ash cyclone, which were too severe to repair while the plant was operating, forced termination of the run. The shutdown was smooth and orderly.

3.1.4 Mechanical Problems

(1) The recarbonated acceptor flow control valve had to be removed and repaired early in the run.

(2) The plant was put on hold for almost a day when the city water supply was lost.

(3) A boiler shutdown caused by a false low feed water level signal resulted in a brief interruption of process steam to the gasifier. The recycle flow rate was quickly increased to make up for the loss in steam and to prevent the bed from slumping.

(4) The secondary regenerator cyclone (L-202A) developed leaks that became too severe to repair while operating the plant. These leaks, caused by erosion, necessitated plant shutdown.

3.1.5 Process Problems

(1) Perhaps the most serious process problem was the increasing char bed density. This prevented ideal steady-state operation. About 36 hours before the end of the run, process alterations (Refer to Paragraph 4.2.4, Page 139) were made which successfully decreased the bed density.

(2) A boot upset was caused by a partially restricted pressure tap which controls the char-acceptor interface level in the boot. A false high-level signal opened the recarbonated acceptor transfer valve and drained the boot of solids. An increase in the carbon monoxide content of the regenerator flue gas indicated that some char had also been transferred from the boot. Acceptor transfer was stopped, the boot was kept well mixed while the tap was purged, then the interface was reestablished and transfer was resumed.

(3) Inspection of the regenerator following the run revealed a deposit on and above the air distributor ring. The deposit extended approximately 18 inches above the ring. During the run, there was no evidence that the deposit was detrimental to the plant operation. The deposit may have reached an equilibrium size, but this can only be determined by longer periods of operation. Regenerator temperature excursions above 1900°F may have caused the agglomeration. A detailed description and analysis of the deposit is presented in the Results, Observations, and Discussion Section of this report.

3.2 CHRONOLOGY OF OPERATIONS

3.2.1 Run 39

Date	Time	Hours Run	Description
9/17	0845		Started pressuring up the plant with air.

Date	Time	Hours Run	Description
9/17	1105		Depressuring in order to repair a leak.
"	1405		Pressuring up the system again.
"	1600		Started the static pressure test.
"	1900		Depressuring the unit again to repair a leak.
"	2130		Pressuring up the plant again.
"	2300		Started the static pressure test.
9/18	0010		Started grinding char for the preheater.
"	0140		Finished the static pressure test.
"	0440		Lit the process heaters and started the recycle heaters.
"	1030		Started the 250°F refractory cure hold. Finished grinding char.
"	2330		Finished the refractory cure holding period, raising the heater temperatures.
9/19	0800		Started the 600°F refractory cure hold.
"	1400		Finished the refractory cure holding period, raising temperatures.
"	2220		Started the 1000°F refractory cure hold.
9/20	0020		Finished the refractory cure holding period, started the heater differential pressure tests.
"	0230		Finished the heater differential pressure tests.
"	0240		Zinc oxide units placed on line.
"	0321		Started feeding dead-burned dolomite to the gasifier via F-204A, fresh lignite feed lockhopper.
"	0500		A restriction near EHS-2010 valve prevented dolomite transfer from the gasifier to the regenerator.
"	0530		Started shutdown procedures.
"	0600		Restriction near EHS-2010 disappeared, returning to normal operating conditions. Resumed feeding dead-burned dolomite to the gasifier. Unable to hold the rock in the gasifier.
"	1030		Started grinding char for the preheater.
"	1135		Started shutdown procedures to check the acceptor transfer valve, LCV-2003.
"	1340		Finished grinding char for the preheater.
"	1800		System depressured.
9/21	0110		Started pressuring up the system. NOTE: Found LCV-2003 valve liner egg-shaped and the shaft twisted. Replaced the shaft.
"	0230		Started the static pressure test.

Date	Time	Hours Run	Description
9/21	0245		Finished the static pressure test.
"	0700		Lit the heaters and started the recycle compressors.
"	0800		Started the heater differential pressure tests.
"	0915		Finished the heater differential pressure tests.
"	2327		Started feeding dead-burned dolomite to the gasifier via F-204A.
9/22	0023		Transferred a batch of dolomite to the regenerator.
"	0031		Started feeding dead-burned dolomite to the regenerator via F-206, fresh acceptor feed lockhopper.
"	0855		Initiated solids circulation.
"	0930		Started the solids circulation tests.
"	1125		Finished the solids circulation tests. Started the gas circulation test.
"	1130		Finished the gas circulation test.
"	1139		Shut down J-202, main air compressor, for maintenance.
"	1515		J-202 placed back on line.
"	1600		Initiated steam flow to the gasifier side.
"	1745		Started feeding char to the gasifier.
"	1910		Started the heater differential pressure tests.
"	1930		Finished the heater differential pressure tests.
"	2045		Initiated air flow to the gasifier side.
"	2325		Started steam flow to the gasifier boot.
9/23	0100		Started the steam heater differential pressure test.
"	0120		Finished the heater differential pressure test.
"	0130		Started feeding Velva lignite to the pre-heater.
"	0143		Initiated char transfer.
"	0505		Started feeding auxiliary char to the regenerator.
"	0535	0	Regenerator at 1800^{o}F.
"	0645-1500		Char transfer unstable all day long.
"	1500		Shut down the 100 area for maintenance.
"	1645	11.2	Due to notification by the city that the water supply will be cut off, started setting up the plant for a holding period. Removed steam from the system, stopped char feed, allowing the system to ride on the process heaters, and leaving stone circulation at a minimum; shut down the boiler, maintaining the system quenches with cooling tower water.

Date	Time	Hours Run	Description
9/24	1415		City water supply returned to the plant.
"	1704		Started steam flow to the gasifier side.
"	1726		Removing steam flow to the side due to a leak on the control valve flange.
"	1825		Began grinding Velva lignite for the preheater.
"	1852		Started feeding char to the gasifier.
"	1905		Started steam flow to the gasifier side.
"	1948		Started feeding dead-burned dolomite to the regenerator.
"	1951		Began air addition to the gasifier.
"	1955		Initiated auxiliary char feed to the regenerator.
"	2100		Difficulty in establishing char transfer.
9/25	0745		Tried the usual procedures for establishing fuel char transfer several times, transfer finally established.
"	0715		Started feeding Velva lignite to system.
"	0800	0	Regenerator at 1800°F.
"	0936		Initiated fresh limestone feed to the system.
"	1100		Sheared a pin on L-204, fresh limestone feeder.
"	1117		Feeding fresh limestone with the feeder bypass until the sheared pin is repaired.
"	1250		Initiated the air removal procedure.
"	1305		L-204 feeder repaired.
9/26	0450		Finished grinding Velva lignite for the preheater.
"	0750		All air out of the gasifier side flow.
"	1200		Started grinding Glenharold lignite for the preheater.
"	2400	40	Plant condition very good.
9/27	0630		Found the bypass around boot recycle flow transmitter, FT-2020, open.
"	2025		Steam-recycle gas flow to the gasifier boot at a 75-to-25 ratio.
"	2400	64	Plant operation smooth.
9/28	0245		Placed methanation unit on line.
"	1515		Experienced a slight upset from the loss of coal feed for a short time.
"	2400	88	Plant operation smooth.
9/29	0805		Experiencing trouble with S-9 sample station.
"	0855		After clearing S-9 sample station, had to cut the air loading on calcined acceptor transfer valve, TCV-2030, to regain normal circulation.

Date	Time	Hours Run	Description
9/29	1125		Experienced a power dip, kicked off cooling water pumps.
"	1845		Placed the Elliott turbine blade test stand on line.
"	2220		Removed the Elliott turbine blade test stand from service due to a high dP across the metering orifice.
"	2300		Due to a high junk level in the system, increasing the velocity of gas in the regenerator by adding recycle gas.
"	2330	111.5	Elliott test stand taken off line.
9/30	0025		Removing part of the recycle gas flow to the regenerator due to the loss of vessel temperature.
"	0500		Lost the steam boiler because of low water level. Bounced the system enough to lose char transfer. Methanation unit taken off line.
"	0515		Regained char transfer and lining out the system.
"	0830		L-202B, regenerator cyclone, developed a hole. Maintenance working on placing a metal band over it.
"	0850		L-204, fresh limestone feeder, sheared a pin, opened the bypass to maintain feed.
"	0933		L-204 repaired.
"	1045		Shut down grinding to repair the preheater cyclone inlet.
"	1310		L-202B repaired by maintenance.
"	1610		Resumed grinding in the 100 area.
"	1630	128.5	Several gasifier boot differential pressure taps plugged, blew the interface, stopped fresh limestone feed, lignite feed and overhead circulation.
"	1950		Began grinding char to tote bins.
"	2055		System lining out from previous upset.
"	2100		L-202A, regenerator cyclone, developed a leak, maintenance working on it.
"	2330	135.5	Resumed grinding lignite for the preheater.
10/1	0105		The Redler conveyor which feeds lignite to the grinding mill surge pot sheared a pin, stopping lignite grinding.
"	0200		Placed the Elliott test stand on line
"	0222		Redler conveyor repaired, resumed grinding.
"	0400		The leak on F-204A repaired.
"	0410		Finished grinding lignite for the preheater.
"	0945		Resumed grinding lignite.
"	1323		Experienced a power dip, nothing shut down.
"	2400	160	Working on lowering the density of the char bed in the gasifier.

Date	Time	Hours Run	Description
10/2	0805		Removed the last of the recycle gas from the regenerator side flow.
"	1100		Making system changes to increase the gasifier temperature.
"	2400	184	Lining the system out.
10/3	0230		L-202A leaking again.
"	0700		Removed the Elliott test stand from service.
"	0710		Placed the Elliott test stand back on line.
"	0900	192	Initiated shutdown procedures due to the leak on the cyclone L-202A.
"	1005		Stopped grinding lignite for the preheater.
10/4	0400		Depressuring the unit.
"	1400		System empty of stone, pressuring back up to cool system down.
10/5	0400		Depressuring the unit.

4 RESULTS, OBSERVATIONS, AND DISCUSSION

4.1 BACKGROUND

Prior to Run 39 Glenharold lignite was used as feedstock in Runs 32, 34, 35, and 36. In the first three of these runs, agglomerated ash deposits formed in the gasifier transition section on the gas distribution ring. The sodium and silica-enriched deposits formed during start-up when air was injected through the gas distribution ring into the gasifier. These deposits grew inward toward the center of the vessel. Localized hot spots resulting from the rapid combustion of hydrogen, carbon monoxide, and methane in front of the ring caused sodium constituents in the char to melt. The sticky char particles agglomerated and the carbon was burned away in the oxygen-rich environment.

Hence, to prevent the formation of these deposits, hot spots in the char bed would have to be avoided. This was successfully accomplished in Run 36 by modifying the startup procedure to eliminate the need for air in the gasifier while Glenharold lignite was being fed to the system.

Run 36 revealed the presence of another sodium related problem. As the run progressed, sodium was transferred from the char ash to the circulating acceptor inventory. When the sodium (Na_2O) concentration of the acceptor reached 2.5 weight percent, the acceptor agglomerated in the gasifier boot. This occurrence was sudden and unexpected. In subsequent laboratory studies, it was found that under normal gasifier boot operating conditions of 11 atmospheres steam partial pressure the transferred sodium made the acceptor surface melt and become sticky. This melt condition was found to be promoted by high steam partial pressure and low boot temperature. Further testing indicated that operating the boot at 1500°F with 10 atmospheres steam pressure would avoid melt formations at the sodium concentrations experienced in Run 36. The demonstration of this procedure was planned for Run 39.

Lower boot steam partial pressure can be obtained by reducing the system operating pressure or by diluting the steam with recycle gas. For expediency the latter method was used in Run 39. A conservative 8.7 atmospheres steam partial pressure was maintained with a 3-to-1 steam-to-recycle ratio.

Prior to the run, a manual shutoff valve was installed in the fuel char standleg. This new valve would help maintain the standleg seal if char transfer were lost. This seal is essential for regaining char transfer.

4.2 ACCOMPLISHMENTS AND OBSERVATIONS

4.2.1 Major Operational Achievements

The pilot plant operations for Run 39 are summarized below:

SUMMARY OF PLANT OPERATIONS

	Hours of Operation
Acceptor Circulation	266
Process Conditions	192
Fresh Acceptor Makeup	191
Without Air in Gasifier	169
Boot Maintained at 8.7 ATM	132
Velva Lignite Feed	29
Glenharold Lignite Feed	165
Methanation Unit on Line	53

The run clearly demonstrated the success of reduced steam partial pressure in eliminating the formation of massive boot deposits that terminated previous Glenharold runs. The Na_2O content of the acceptor had stabilized at less than 1 weight percent in Run 39. A comparison of the sodium buildup on the acceptor in Runs 39 and 36 (Figure 39-1) indicates that this previous process problem can be successfully controlled.

The run also yielded two quasi-steady-state periods for which heat and material balances can be calculated for the gasification section. The first period ended after 17 hours when the boiler shut down due to a false instrument signal. This stable period was marred only by a gradual increase in the gasifier char bed density from 36 to 39 pounds per cubic foot. The second period occurred during the last 21 hours of operation. This period spanned a reduction in bed density from 35 to 32 pounds per cubic foot.

A smooth and orderly shutdown was made when leaks caused by erosion in the regenerator external ash cyclone could not be repaired.

4.2.2 Plant Data

Tables 39-1 through 39-12 summarize the plant data for Run 39. Operating conditions are shown in Tables 39-1 and 39-2. Feedstock composite analyses are presented in Table 39-3. Effluent and circulated process stream solids analyses are presented in Tables 39-4 through 39-10. Tables 39-11 contains the plant pressure balance data and Table 39-12 shows average preheat temperatures throughout the balance periods. The locations and elevations for the pressure points are shown

in Figure 39-2. The pressure balance results, shown in Table 39-12, were calculated by correcting the raw data as described in the Run 17 report and then forcing the summation of the pressure drops to converge as described in the Run 28 report. Table 39-13 contains the analyses of the regenerator deposits sampled at the end of the run. A discussion of these deposits can be found in Subsection 4.4, Problems.

4.2.3 Activity

The acceptor activity, defined as the moles of active calcium oxide per mole of calcium in the stone, serves as a measure of the acceptor's ability to react with CO_2. Activity is plotted as a function of time in Figure 39-3. Run 39 progressed long enough to completely replace the dead-burned dolomite with active acceptor. The activity for this run was in the range of 0.16 to 0.18. This is higher than the usual 0.10-to-0.13 range for previous runs. The high activity can be attributed to low acceptor circulation rates and the higher than usual (800 to 1000 pounds per hour) fresh acceptor makeup rate near the end of the run. These two factors translate into fewer calcination-recarbonation cycles and to a reduced system residence time for the aged acceptor.

4.2.4 Intermediate Fines and Gasifier Char Bed Density

From the time that the dead-burned dolomite inventory was replaced by fresh limestone, operation at ideal steady-state conditions was hampered by a constantly rising gasifier char bed density. A high bed density can "choke" the gasifier bed and stem the flow of acceptor. This rising density is caused by a buildup of intermediate fines in the gasifier bed.

Three courses of action were taken in an attempt to minimize the amount of intermediate fines fed to the gasifier: (1) the coal feedstock grind was made coarser to limit the coal fines (-100 mesh material). These fines generally contain the highest proportion of intermediate fines starting material-silica. The coarser grind did not have any noticeable effect on limiting the bed density during the 24 hours after it was initiated.

When the density reached 41 pounds per cubic foot, the second and third steps were taken simultaneously: (2) an additional gas purge was introduced into the top of the calcined acceptor standleg, and (3) fresh acceptor makeup was increased. It was hoped that the purge would strip the fines material from the overhead transfer line, leaving them behind in the regenerator where they would be removed with the spent acceptor. The increased acceptor makeup rate would hasten the replacement of regenerator inventory, which includes the intermediate fines material, with fresh sized acceptor. Within 24 hours of the initiation of Steps 2 and 3, the char bed density dropped to 35 pounds per cubic foot. Before any conclusions are drawn, one more observation should be noted.

Plots of gasifier char bed density and percentage intermediate fines (Figure 39-4) show an increase in the intermediate fines inventory with a subsequent increase in bed density occurring late on September 28, soon after the replacement of fresh limestone for dead-burned dolomite was complete. The accumulation of fines tapered off and held relatively constant between 13 and 17 percent. Although the char bed density seemingly responded to the corrective action administered, the percentage of intermediate fines was unaffected. One explanation for this occurrence may be the significantly reduced boot velocity that existed after the return to stable operating conditions following the boot upset late on September 30. At low boot velocities, larger acceptor particles previously suspended in the char bed would be allowed to fall out. These lower velocities would help reduce the char bed density while having no considerable effect on the intermediate fines.

It was not readily apparent which change or combination of changes was responsible for the recovery of the char bed density control. Use of the stripping purge alone in subsequent runs has not proved to be an effective means of reducing char bed density. Nevertheless, a degenerate condition which could have caused the end of the run was reversed.

4.3 METHANATION

Run 39 was the first attempt to operate the methanation unit since the catalyst was reduced for a second time in Run 36. Because the catalyst was new, conservative operation guidelines were followed. The guidelines conformed closely with those recommended by the catalyst manufacturer: The peak temperatures in the packed tube methanator were limited to 850^{o}F. Higher temperatures were avoided by diluting the synthesis gas to the reactor with dry methanated product gas. A minimum recycle to feed ratio of 1.4 to 1 (wet) was achieved.

Purified synthesis gas was passed through the packed tube reactor for approximately 53 hours in Run 39. Process flow data for this period are presented in Table 39-13. Reactor temperature profiles measured throughout the run, tabulated in Table 39-14 and plotted in Figures 39-6, 39-7, and 39-8, indicate that the peak temperatures occurred 1 foot below surface of the catalyst bed. This is the point in the reactor where the rate of heat removed equals the rate of heat generated. The temperature should begin to rise immediately upon contact of the gas with the catalyst. Because the profiles do not indicate an immediate temperature rise at the top of the catalyst bed, it must be assumed that either the catalyst surface has settled to a point 4 inches lower than the original top of the catalyst bed, or the first 4 inches of the catalyst has deactivated.

Changes in the Dowtherm circulation rate apparently had little effect on the rate of heat transfer in the packed tube reactor. A 55-percent reduction in the initial rate caused no appreciable change in the temperature profiles.

4.4 PROBLEMS

4.4.1 Gasifier Deposits

Inspection of the gasifier was somewhat obscured by water leaking into the vessel during the shutdown. Consequently, the boot was filled with a char-acceptor mudlike mixture. The typical dead-burned deposit was found in the dead space around the wall above the boot distributor. The rest of the gasifier was clean.

4.4.2 Regenerator Deposits

The regenerator condition was very similar in appearance to that of Run 35. Figure 39-5 is a sketch of vessel as observed after Run 39. An analysis of deposit samples can be found in Table 39-15.

The usual deposit under the char inlet formed, as did those on the pressure taps. The wall was covered with a smooth, light brown scale that varies from 1/4- to 1-1/2-inches thick. The material was brittle and easily flaked off the wall. The scale had the appearance of large cobblestones with 1/8- to 1/4-inch cracks between 1- to 1-1/2-square-foot sections. The deposit became thinner towards the top where it had a more blistered texture. Here the walls were fairly dusty as usual. Both transfer lines to the gasifier and F-228 appeared to be clean but had a thin, paper-like scale on the walls. The metal grates protecting the entrances to the calcined acceptor standleg and the purged acceptor dump line were clear with only a thin crust on the bars.

A large deposit was found on and extending 12 to 20 inches above the air distributor ring. All of the gas distributor caps were open to the vessel. About 1 foot above the ring, the regenerator diameter was constricted to about 20 inches. This deposit consisted of three layers. Adjacent to the wall was a conglomerate layer of dead-burned dolomite and limestone. The next layer consisted of yellow fines enriched in Na_2O. Finally, in contact with the process was a hard layer of black material. When the regenerator was cleaned, a total of 865 pounds of deposit and wall scale material was removed.

Regenerator temperature data indicate that the lower part of the regenerator was subjected to substantial periods with temperatures exceeding 1900°F. These periods amounted to a total time of 90 minutes. Since there is only one thermocouple in the region, undetected temperature excursions in excess of 2000°F could easily have occurred. Temperature excursions of this sort can provide ample opportunities for the formation of melts leading to deposits of the type formed in this run.

Run 40 will feature this plant's first attempt to gasify a Texas lignite. Since this is a low-sodium coal, the sodium-related problems associated with the use of Glenharold lignite are not anticipated. The success of this run will greatly extend the possible applications of the CO_2 Acceptor Process.

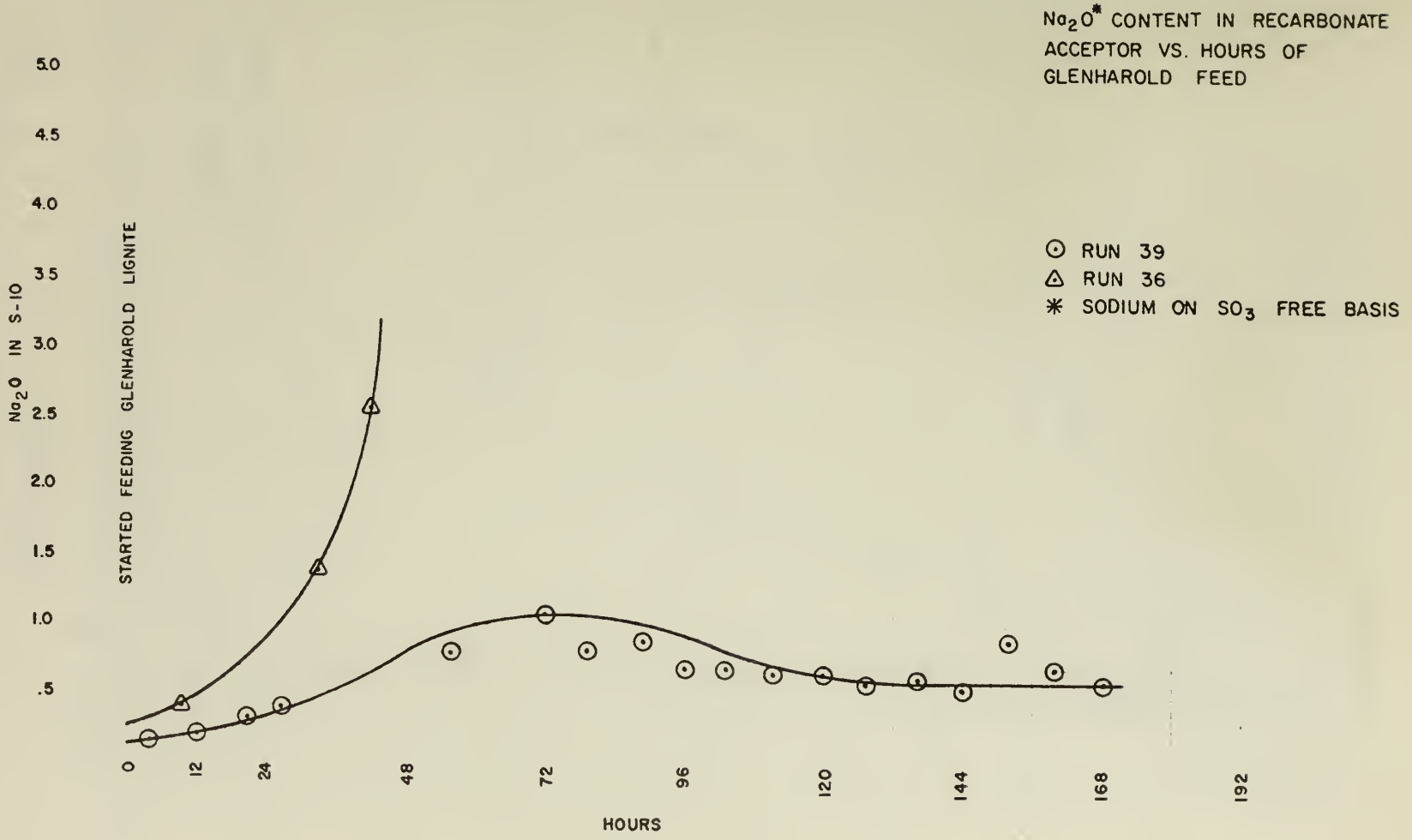

Figure 39-1. COMPARISON OF SODIUM BUILDUP IN RUN 39 WITH THAT IN RUN 36

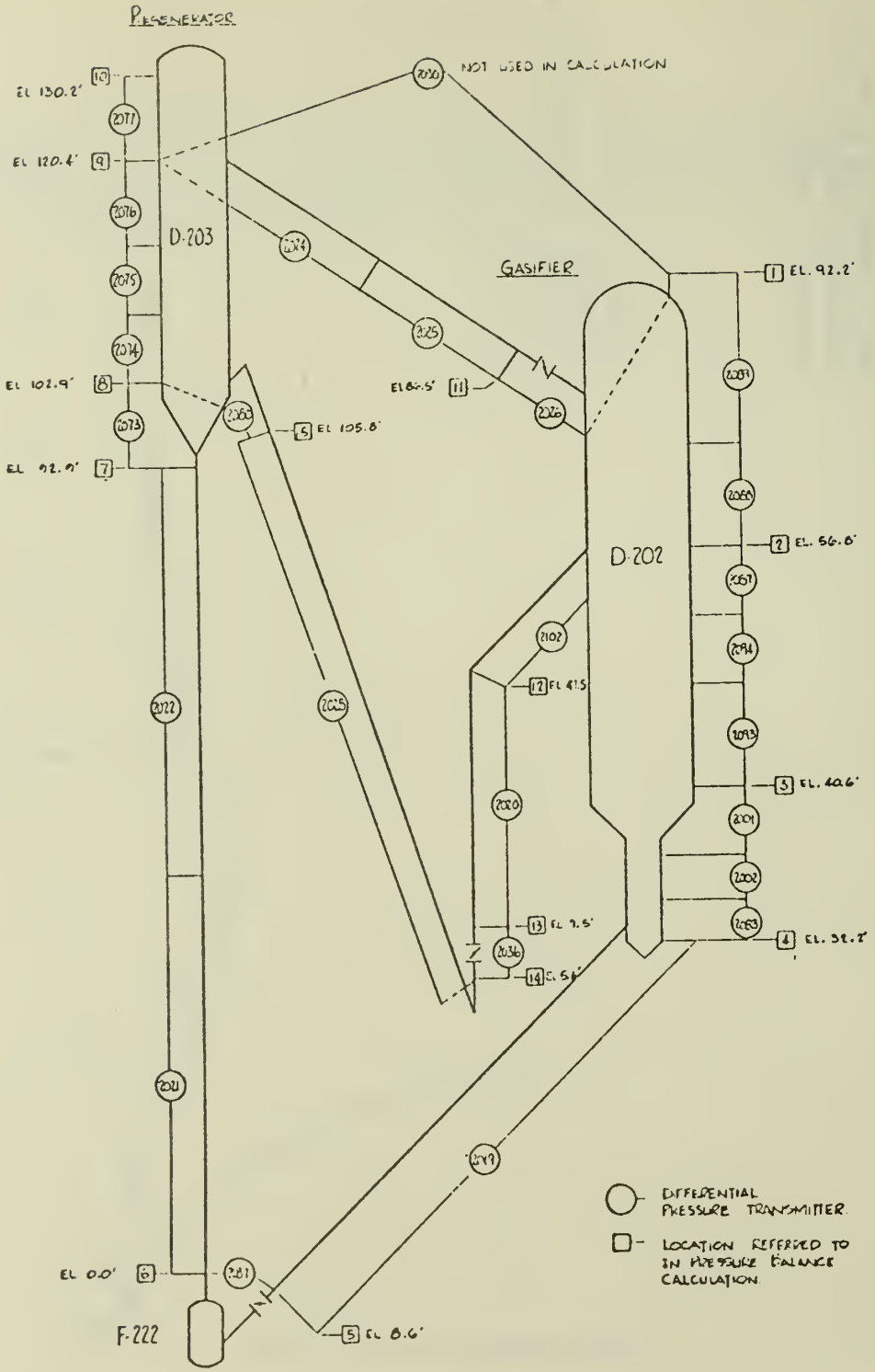

Figure 39-2. LOCATION OF PRESSURE BALANCE POINTS

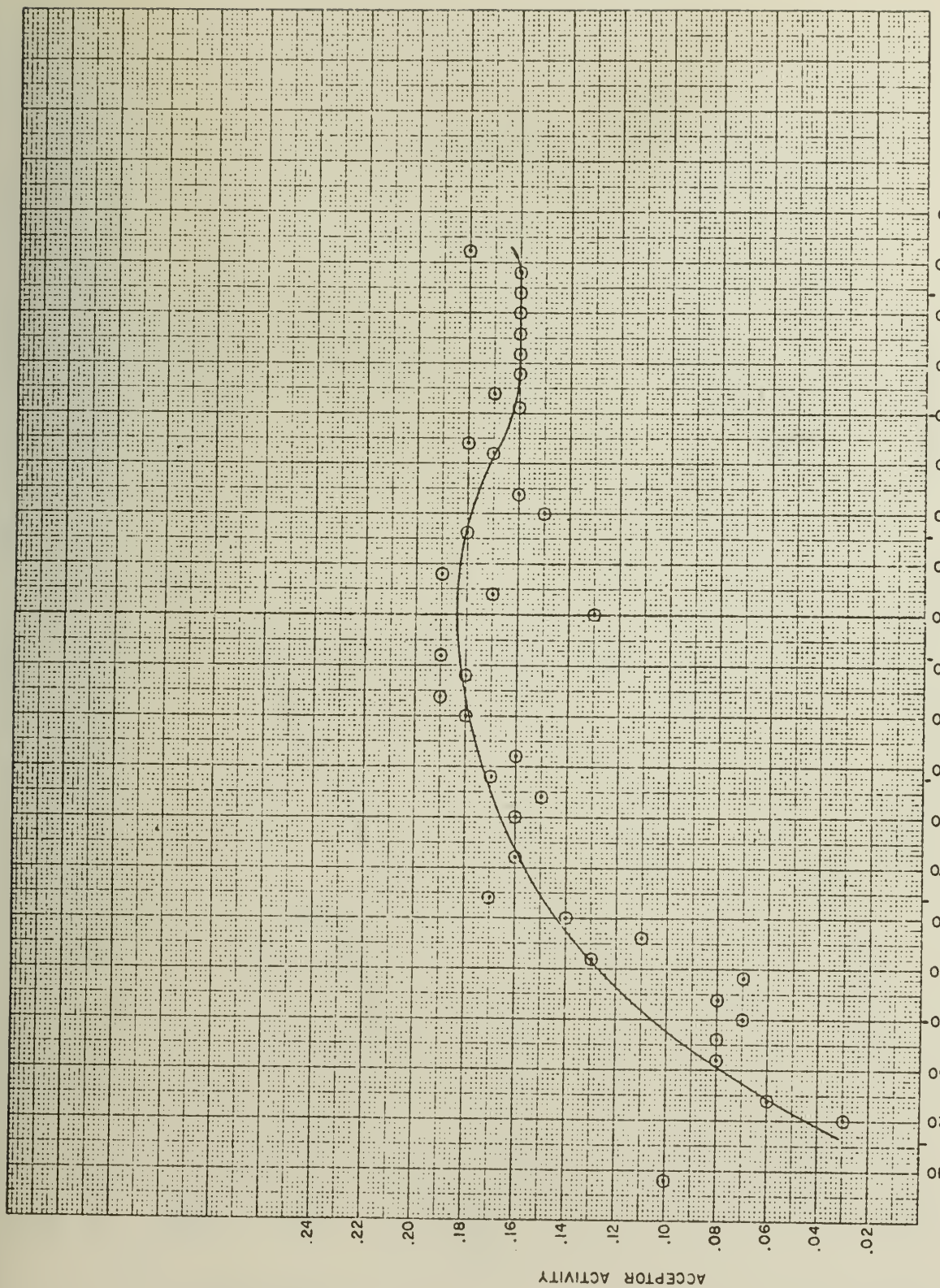

Figure 39-3. ACCEPTOR ACTIVITY

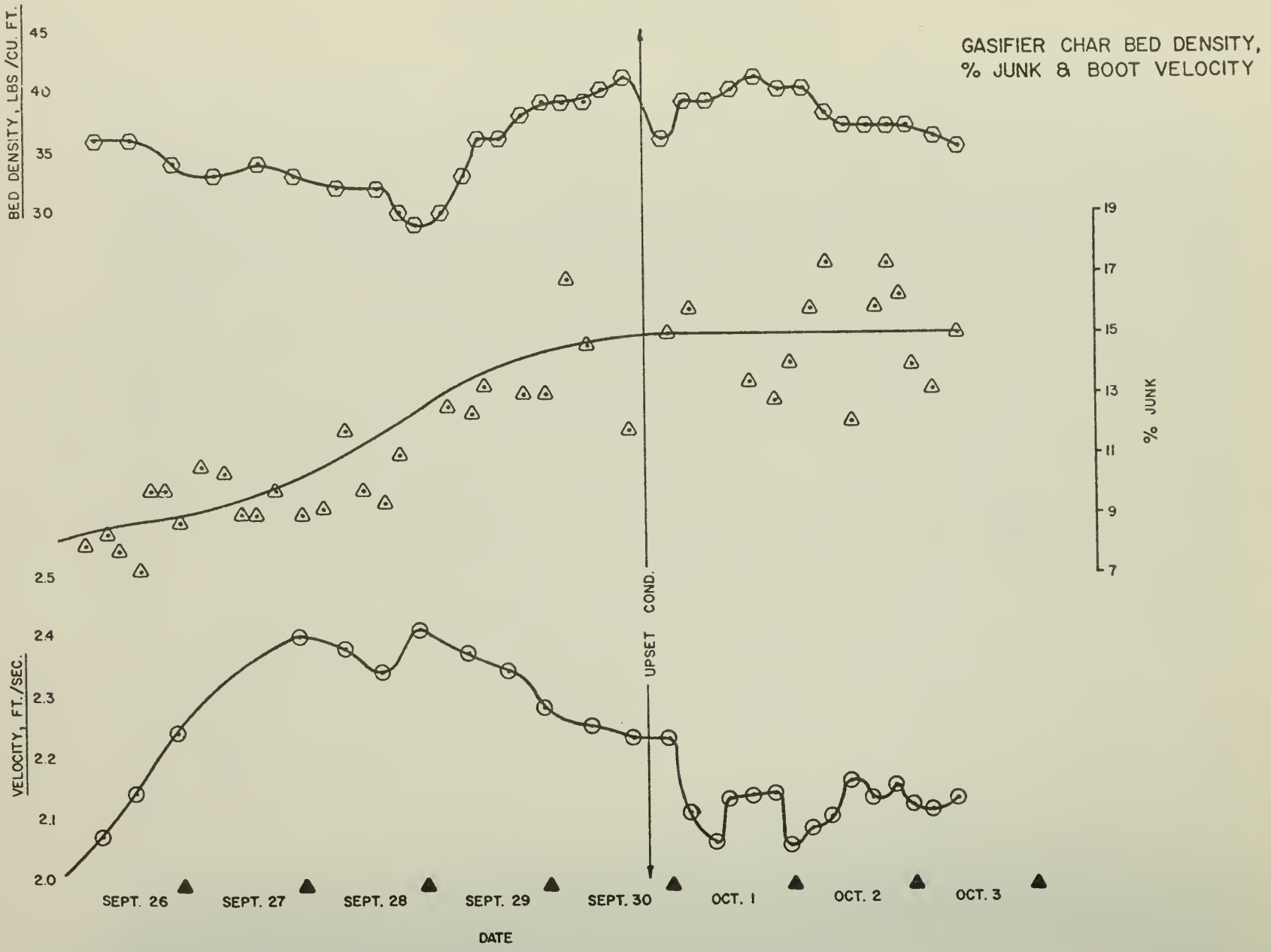

Figure 39-4. GASIFIER CHAR BED DENSITY, PERCENT JUNK AND BOOT VELOCITY

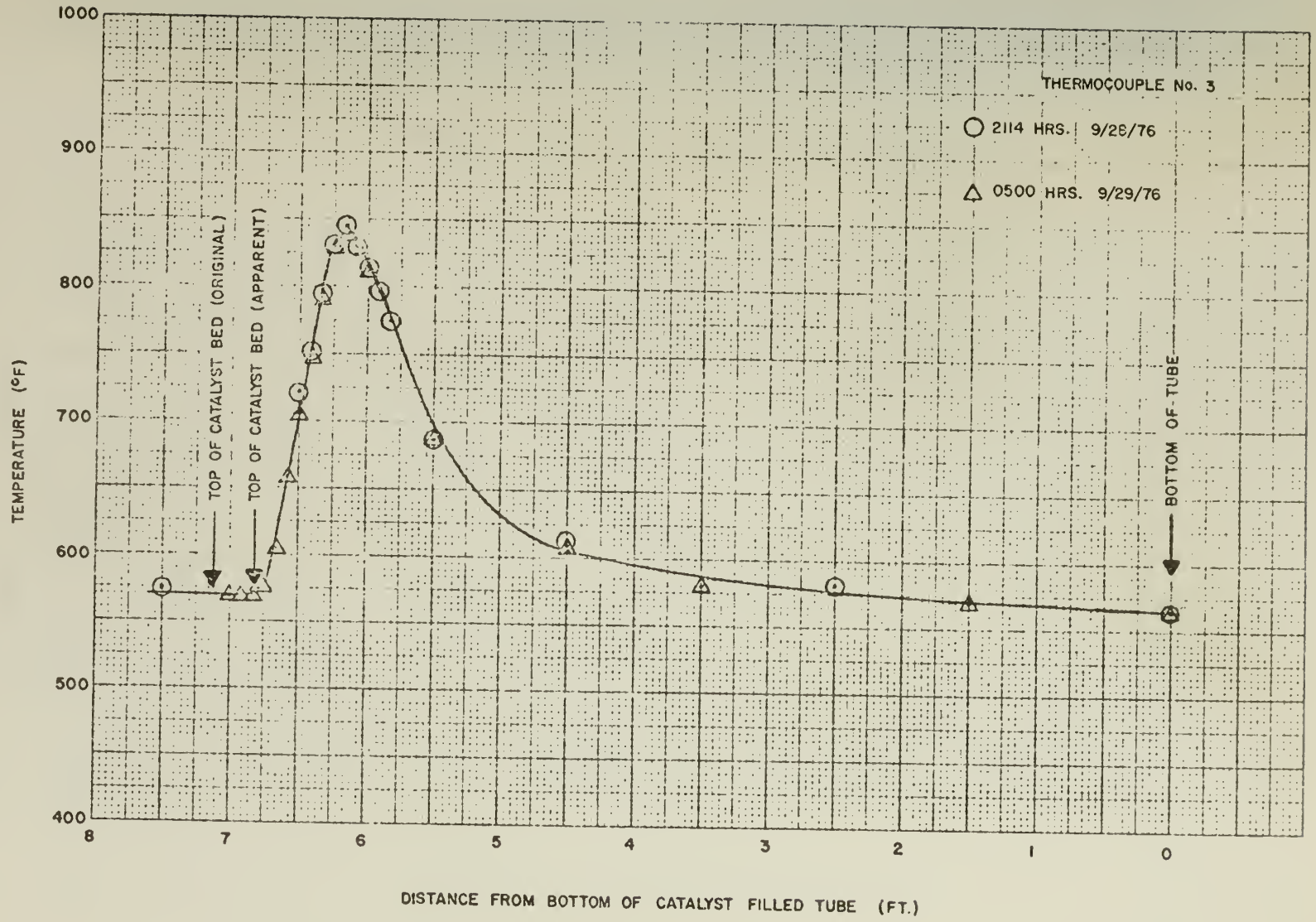

Figure 39-5. PACKED TUBE REACTOR TEMPERATURE PROFILES 2114 HOURS 9/28/76 AND 0500 HOURS 9/28/76

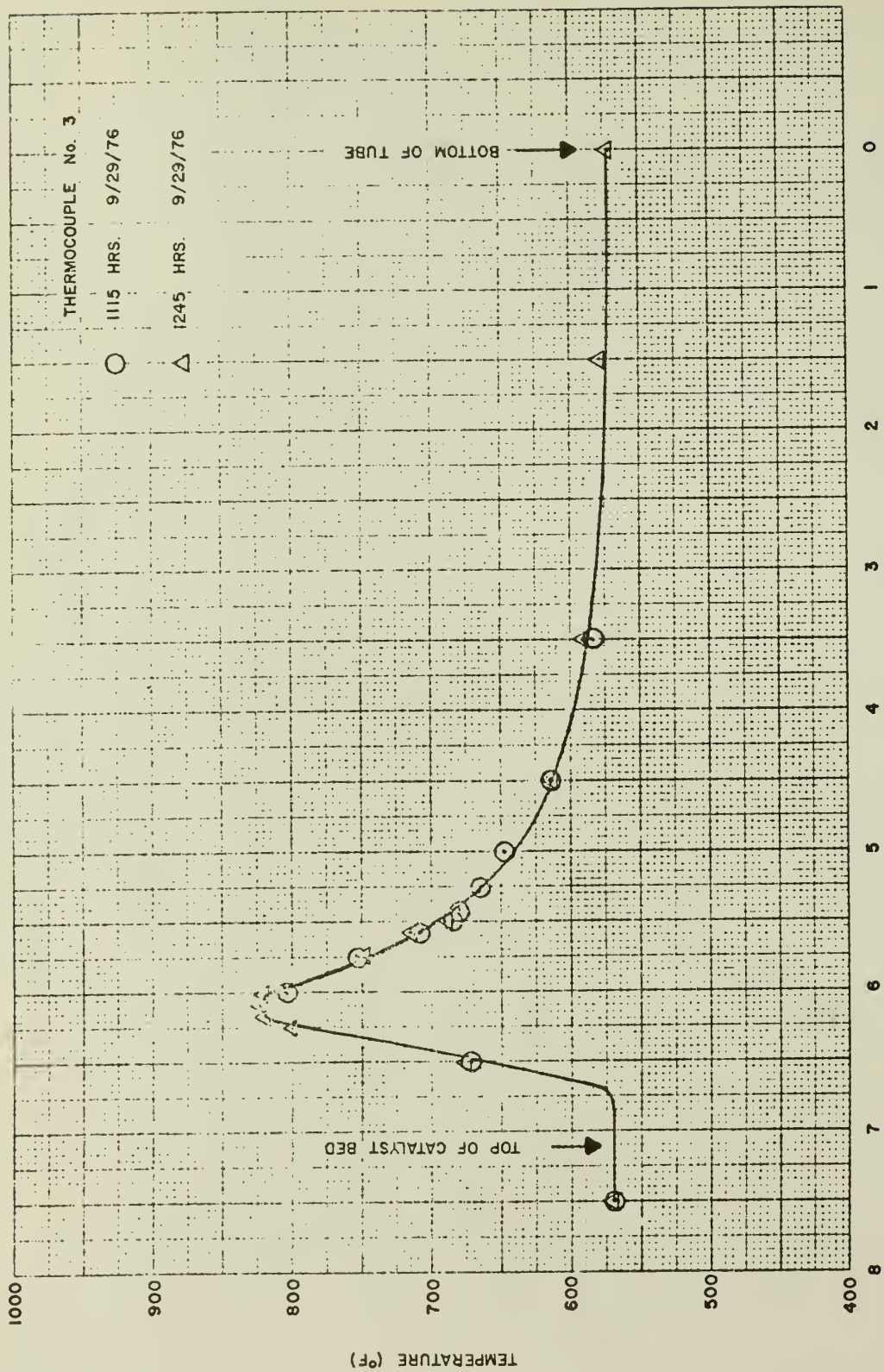

Figure 39-6. PACKED TUBE REACTOR TEMPERATURE PROFILES 1115 HOURS 9/29/76 AND 1245 HOURS 9/29/76

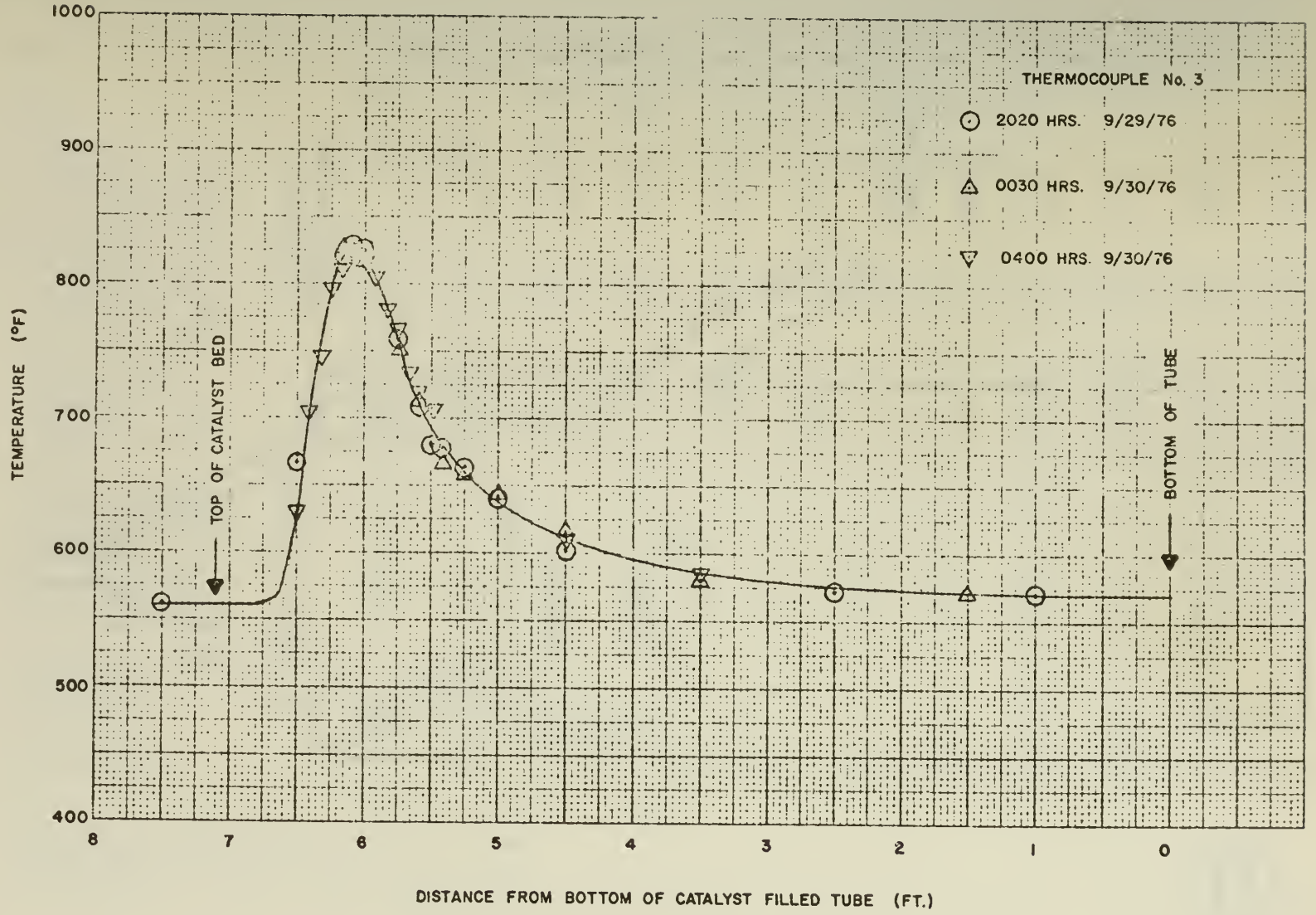

Figure 39-7. PACKED TUBE REACTOR TEMPERATURE PROFILES 2020 HOURS 9/29/76, 0030 HOURS 9/30/76 AND 0400 HOURS 9/30/76

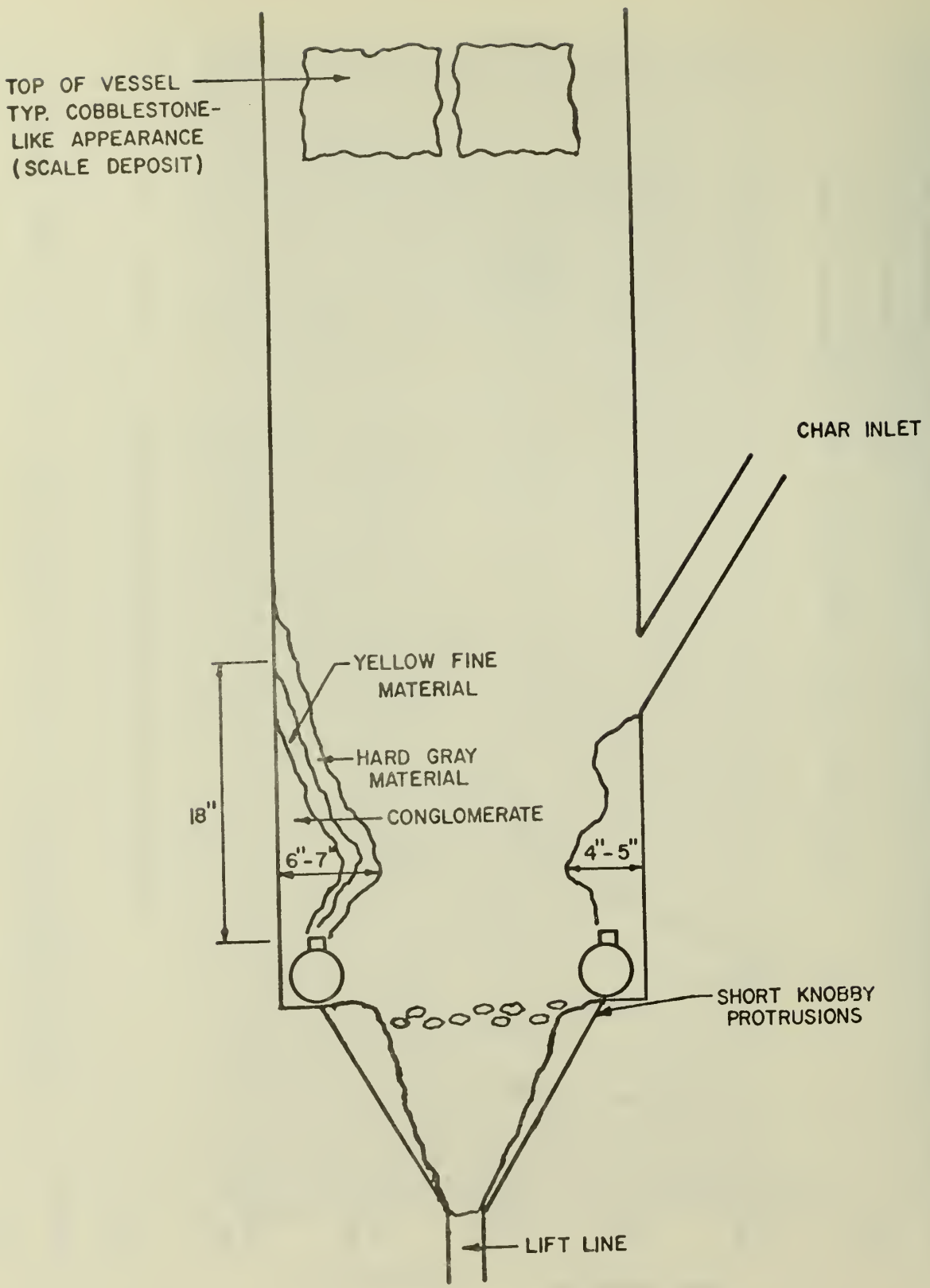

Figure 39-8. REGENERATOR DEPOSIT

Date	9/25/76		← 9/26/76 →			← 9/27/76 →			← 9/28/76 →			9/29/76
Time	1500	2300	0700	1500	2300	0700	1500	2300	0700	1500	2300	0700
Solids												
Feedstock	Velva Lignite		← Glenharold Lignite →									
Feed Rate, lb/hr[1]	2,440	2,440	2,440	2,240	2,120	2,120	2,280	2,440	2,440	2,600	2,560	2,560
Cyclone Solids, lb/hr	234	281	102	91	79	91	145	80	209	73	190	180
Pond Solids, lb/hr	61	44	26	24	27	21	32	25	25	35	39	48
Gas Flows[2]												
Boot Recycle, SCFH	17,050	11,730	11,550	25,730	17,050	22,060	17,060	9,710	10,130	10,310	10,480	9,860
Boot Steam, SCFH	21,140	27,290	27,290	14,120	24,810	23,740	29,480	35,520	34,360	33,340	34,720	34,400
Steam to Side, SCFH	28,890	24,460	25,230	26,370	25,440	24,860	24,270	23,390	21,960	21,890	21,930	21,910
Air to Side, SCFH	15,690	6,890	2,780	0	0	0	0	0	0	0	0	0
Purges												
Recycle, SCFH	2,810	3,200	3,130	3,240	3,450	3,470	3,830	3,580	3,470	3,760	3,810	3,390
Inert, SCFH	300	450	500	310	470	410	370	430	370	360	330	350
N_2, SCFH	880	920	760	760	690	390	460	340	340	760	580	150
Total Flow In, SCFH	86,760	74,940	71,240	70,530	71,910	74,930	75,470	72,970	70,630	70,420	71,850	70,060
Vent Rate, SCFH	63,850	53,180	45,300	30,730	35,010	35,030	46,380	48,830	48,560	50,040	48,080	44,080
Bed Conditions												
Boot Velocity, ft/sec	2.05	2.09	2.07	2.14	2.24	2.44	2.48	2.40	2.38	2.34	2.41	2.37
Bed Velocity, ft/sec	0.90	0.77	0.73	0.71	0.72	0.72	0.74	0.71	0.70	0.70	0.71	0.70
Boot Density, lb/cu ft[3]	96	95	95	87	83	77	72	71	71	75	62	62
Bed Density, lb/cu ft[3]	40	36	36	36	34	33	34	33	32	32	29	33
Boot Temperature, °F	1509	1510	1501	1513	1506	1495	1497	1489	1502	1507	1498	1504
Bed Temperature, °F	1503	1506	1495	1500	1490	1481	1493	1483	1499	1500	1488	1501
Bed Height, ft[3]	22.0	22.8	24.4	27.2	27.6	26.0	25.6	24.0	25.0	25.4	25.6	27.0
Overhead Compositions												
CO, Dry Mol %	16.6	16.5	14.9	14.7	14.5	14.1	15.0	15.4	14.3	15.2	14.4	14.6
CO_2, Dry Mol %	18.7	15.8	16.5	14.8	14.6	14.2	8.2	12.7	12.4	9.5	9.6	13.3
N_2, Dry Mol %	20.0	12.0	7.7	5.5	4.7	5.3	3.8	3.3	3.2	3.6	3.4	3.7
H_2, Dry Mol %	37.8	45.8	49.4	52.4	53.3	53.3	60.0	58.1	58.3	59.9	58.1	56.6
CH_4, Dry Mol %	6.9	9.9	11.5	13.6	13.3	13.1	13.0	12.0	11.8	12.2	12.1	11.8

(1) Determined by feeder rpm - 407 X RPM.
(2) Determined by orifice flow meter measurements.
(3) Determined by differential pressure measurements.

Table 39-1. GASIFIER DATA (Sheet 1 of 2)

Date	9/29/76			9/30/76				10/1/76			10/2/76			10/3/76
Time	1500	1900	2300	0300	0700	1500	2300	0700	1500	2300	0700	1500	2300	0700
Solids														
Feedstock	Glenharold Lignite													
Feed Rate, lb/hr[1]	2,560	2,560	2,560	2,560	2,120	2,440	2,040	2,340	2,340	2,440	2,440	2,440	2,440	2,440
Cyclone Solids, lb/hr	120	185	185	185	174	190	140	151	171	156	131	111	169	136
Pond Solids, lb/hr	55	55	48	48	87	63	46	50	57	25	41	33	30	27
Gas Flows[2]														
Boot Recycle, SCFH	9,960	10,290	10,630	10,540	10,760	10,150	-	10,530	10,340	9,990	10,630	10,280	9,670	10,140
Boot Steam, SCFH	34,180	33,440	32,240	32,240	31,730	31,790	-	28,690	29,750	28,730	28,940	29,780	30,220	29,980
Steam to Side, SCFH	21,970	22,050	22,180	22,130	22,080	22,050	-	22,280	22,000	22,040	22,040	22,180	22,190	22,040
Air to Side, SCFH	0	0	0	0	0	0	-	0	0	0	0	0	0	0
Purges														
Recycle, SCFH	3,090	3,420	3,750	3,710	3,780	3,750	3,560	3,700	3,870	3,170	3,680	3,650	2,710	3,790
Inert, SCFH	320	320	300	300	260	330	380	330	340	460	420	360	410	420
N_2, SCFH	840	460	460	460	340	460	470	610	640	0	0	0	0	0
Total Flow In, SCFH	70,360	69,980	69,560	69,380	68,950	68,530	-	66,140	66,940	64,390	65,710	66,250	65,200	66,370
Vent Rate, SCFH	47,640	48,220	48,820	48,130	42,450	46,310	-	43,540	45,520	42,980	45,730	43,780	46,390	45,490
Bed Conditions														
Boot Velocity, ft/sec	2.34	2.26	2.28	2.20	2.25	2.23	-	2.06	2.13	2.05	2.10	2.13	2.12	2.13
Bed Velocity, ft/sec	0.70	0.69	0.68	0.68	0.68	0.67	-	0.64	0.66	0.65	0.65	0.66	0.65	0.64
Boot Density, lb/cu ft[3]	63	63	65	65	65	65	-	65	65	63	63	63	63	63
Bed Density, lb/cu ft[3]	36	38	39	39	39	41	-	39	41	35	35	34	34	32
Boot Temperature, °F	1,484	1,493	1,493	1,486	1,484	1,489	-	1,473	1,490	1,480	1,486	1,490	1,493	1,486
Bed Temperature, °F	1,479	1,487	1,489	1,481	1,481	1,481	-	1,469	1,484	1,470	1,483	1,485	1,487	1,479
Bed Height, ft[3]	25.4	25.6	26.0	26.0	29.0	24.0	-	25.0	25.2	25.0	25.0	26.4	26.0	25.4
Overhead Compositions														
CO, Dry Mol %	14.0	14.3	14.3	13.8	14.3	13.6	-	13.1	12.7	12.0	13.0	13.2	12.4	12.9
CO_2, Dry Mol %	8.2	7.3	6.4	6.9	5.2	6.9	-	6.9	8.1	10.1	6.9	8.0	12.7	9.0
N_2, Dry Mol %	3.7	4.1	4.6	5.1	5.9	4.5	-	6.3	5.3	6.2	6.8	5.4	5.5	5.6
H_2, Dry Mol %	60.8	61.6	61.4	60.9	61.7	61.9	-	60.6	60.9	58.4	60.3	60.2	57.2	59.5
CH_4, Dry Mol %	13.3	12.7	13.3	13.3	12.8	13.1	-	13.1	13.0	13.3	13.0	13.2	12.2	13.0

(1) Determined by feeder RPM - 407 X RPM.
(2) Determined by orifice flow meter measurements.
(3) Determined by differential pressure measurements.

Table 39-1. GASIFIER DATA (Sheet 2 of 2)

Date	9/25/76		← 9/26/76 →			← 9/27/76 →			← 9/28/76 →			9/29/76
Time	1500	2300	0700	1500	2300	0700	1500	2300	0700	1500	2300	0700
Solids												
Acceptor Feedstock	← Minnekahta Limestone →											
Acceptor Makeup, lb/hr[1]	600	562	562	562	562	562	562	562	562	562	562	562
Acceptor Circulation, lb/hr[2]	9,080	11,780	11,190	10,300	9,690	10,300	12,100	10,580	12,680	12,720	9,410	8,810
Ash and Attrited Acceptor, lb/hr[3]	-	-	207	215	163	139	120	150	108	108	151	188
Acceptor Withdrawal, lb/hr[3]	447	195	195	368	454	447	407	459	449	512	536	191
Auxiliary Char Feed, lb/hr[1]	74	111	111	55	55	55	44	44	147	147	185	111
Gas Flows[4]												
Acceptor Lift, SCFH	54,600	54,580	54,540	54,600	54,580	54,480	54,530	54,160	54,040	53,990	54,200	54,220
Char Lift, SCFH	10,090	10,100	10,100	10,040	10,090	10,100	10,000	10,170	10,180	9,950	10,060	10,140
Air to Ring, SCFH	73,060	78,550	81,480	79,570	79,870	78,350	79,500	85,190	87,200	89,000	90,720	87,730
Recycle to Ring, SCFH	23,550	10,240	0	0	0	0	0	0	0	0	0	0
Purges												
Recycle, SCFH	3,240	2,840	3,120	3,210	2,670	2,810	2,800	2,650	2,740	2,810	2,910	2,810
Nitrogen, SCFH	350	360	340	340	330	300	310	290	290	340	320	270
Inert, SCFH	1,060	780	1,020	690	910	1,200	1,030	1,350	880	610	850	680
Total Flow In, SCFH	165,950	157,450	150,600	148,450	148,450	147,240	148,170	153,810	155,330	156,700	159,060	155,850
Vent Rate, SCFH	91,390	102,160	111,930	106,360	106,400	106,900	107,880	115,770	117,110	120,060	126,120	117,840
Bed Conditions												
Inlet Velocity, ft/sec	2.99	2.87	2.73	2.71	2.73	2.67	2.69	2.79	2.82	2.84	2.91	2.85
Bed Density, lb/cu ft[5]	92	86	85	80	76	71	68	68	65	62	61	56
Average Bed Temperature, ^{o}F	1829	1847	1842	1855	1867	1844	1844	1841	1837	1833	1860	1851
Bed Height, ft[5]	18.2	19.4	19.7	19.4	19.7	19.7	19.4	19.8	18.9	20.0	20.7	18.5
Overhead Gas Analyses												
CO, Dry Mol %	3.25	3.06	2.99	4.45	4.56	4.56	1.47	2.51	2.33	2.69	3.94	2.60
CO_2, Dry Mol %	23.74	25.03	26.76	27.19	28.51	28.96	30.74	30.74	31.65	29.40	28.07	29.40
N_2, Dry Mol %	73.01	71.91	68.26	68.35	66.93	66.49	67.78	66.75	66.03	67.91	67.99	68.00

(1) Determined by feeder rpm: Limestone, 281 X RPM; auxiliary fuel, 368 X RPM.
(2) Determined by lift line pressure drop.
(3) Determined by weigh scale.
(4) Determined by orifice flow measurements.
(5) Determined by bed pressure drop.

Table 39-2. REGENERATOR DATA (Sheet 1 of 2)

Date	9/29/76			9/30/76			10/1/76			10/2/76			10/3/76
Time	1500	1900	2300	0300	0700	1500	0700	1500	2300	0700	1500	2300	0700
Solids													
Acceptor Feedstock	Minnekahta Limestone												
Acceptor Makeup, lb/hr[1]	562	583	583	583	583	583	562	1,124	1,124	1,124	843	843	843
Acceptor Circulation, lb/hr[2]	8,200	6,700	7,010	6,700	5,830	6,720	5,270	6,690	6,680	6,680	8,170	8,180	9,080
Ash and Attrited Acceptor, lb/hr[3]	287	285	286	166	166	92	158	210	213	170	167	154	88
Acceptor Withdrawal, lb/hr[3]	298	345	331	385	235	235	110	494	1,064	819	455	484	1,107
Auxiliary Char Feed, lb/hr[1]	185	190	185	190	129	221	258	258	350	221	107	147	228
Gas Flows[4]													
Acceptor Lift, SCFH	54,160	54,260	54,420	54,220	54,280	54,200	53,840	55,110	55,400	55,400	55,400	55,420	55,500
Char Lift, SCFH	9,920	10,030	10,050	10,040	10,150	9,900	10,010	9,900	9,970	10,070	9,950	9,950	10,030
Air to Ring, SCFH	87,110	86,860	86,470	90,720	86,610	82,210	87,130	93,060	93,060	93,450	86,890	88,100	89,820
Recycle to Ring, SCFH	0	0	0	10,170	10,180	5,080	10,100	0	0	0	0	0	0
Purges													
Recycle, SCFH	2,720	2,820	2,720	3,060	2,770	2,730	2,820	2,660	2,960	2,810	2,670	2,910	4,620
Nitrogen, SCFH	350	270	310	300	290	310	320	330	260	260	260	260	260
Inert, SCFH	760	760	590	590	420	900	950	1,020	1,690	1,690	1,220	1,890	1,690
Total Flow In, SCFH	155,020	155,000	154,560	168,950	164,700	155,330	165,170	162,080	163,340	163,680	156,390	158,530	161,920
Vent Rate, SCFH	114,040	116,920	106,940	121,550	113,280	114,220	107,530	113,040	121,090	112,620	104,390	108,100	106,360
Bed Conditions													
Inlet Velocity, ft/sec[5]	2.82	2.83	2.82	3.09	3.02	2.82	3.01	2.95	2.96	2.97	2.85	2.87	2.89
Bed Density, lb/cu ft[5]	56	56	57	58	56	62	58	60	60	59	58	56	58
Average Bed Temperature, °F	1,838	1,852	1,843	1,846	1,853	1,836	1,845	1,841	1,843	1,847	1,852	1,847	1,838
Bed Height, ft[5]	19.4	19.7	19.5	18.8	18.9	21.9	19.8	20.0	19.7	20.4	18.5	19.7	20.1
Overhead Gas Analyses													
CO, Dry Mol %	3.74	3.25	2.97	3.84	3.25	4.04	4.45	2.78	4.04	2.97	3.06	2.69	4.99
CO_2, Dry Mol %	28.07	27.63	28.51	27.63	28.07	27.19	27.63	29.40	28.51	29.40	28.51	28.96	27.19
N_2, Dry Mol	68.19	69.12	68.52	68.53	68.08	68.77	67.91	67.82	67.45	67.63	68.43	68.36	67.82

(1) Determined by feeder RPM: Limestone, 281 X RPM; auxiliary fuel, 368 X RPM.
(2) Determined by lift line pressure drop.
(3) Determined by weigh scale.
(4) Determined by orifice flow measurements.
(5) Determined by bed pressure drop.

Table 39-2. REGENERATOR DATA (Sheet 2 of 2)

Date 9/25/76 - 10/3/76

	Acceptor		Coal	
Screen Size, Wt % Tyler Mesh	Minnekahta Limestone	Screen Size, Wt % Tyler Mesh	Husky Char	Glenharold Lignite
+6	0.1	+8	Tr	+
6 X 8	45.8	8 X 10	1.1	2.2
8 X 9	33.7	10 X 14	8.2	6.2
9 X 10	15.6	14 X 20	11.3	9.9
10 X 12	3.1	20 X 28	13.3	14.5
12 X 14	1.0	28 X 35	19.0	18.7
14 X 16	0.2	35 X 48	20.8	22.0
16 X 20	0.1	48 X 65	10.6	13.3
20 X 24	0.1	65 X 100	6.4	7.1
24 X 28	0.1	100 X 200	6.4	4.0
-28	0.2	200 X 325	1.8	1.2
		-325	1.2	0.9
Ultimate Analysis, Wt %				
Moisture			4.0	0.25
C			67.26	64.13
H + Moisture H			3.08	3.89
N			0.73	0.84
S			1.17	0.71
Ash + SO_3			15.67	8.29
Elemental Analysis, Wt %				
SiO_2	3.28		40.29	27.57
SO_3	0.10		18.65	16.06
Na_2O	0.03		2.27	6.32
CaO	44.73		19.38	26.58
MgO	0.95		4.50	6.30
K_2O	0.04		0.42	0.56
Al_2O_3	0.67		8.60	10.44
Fe_2O_3	0.30		5.46	6.27
P_2O_5	0.02		0.03	0.08
TiO_2	0.04		0.41	0.46

Table 39-3. FEEDSTOCK COMPOSITES

Date	9/25/76		← 9/26/76 →			← 9/27/76 →			← 9/28/76 →			← 9/29/76 →				
Time	0845	1600	0000	0800	1615	0000	0800	1600	0000	0800	1600	0000	1000	1345	1600	2000
Screen Size, Wt % Tyler Mesh																
+6	0.1	↓	↓	↓	↓	↓	0.3	↓	↓	0.3	↓	↓	1.4	↓	↓	1.4
6 X 8	0.1	1.5	3.8	6.3	14.3	21.4	24.8	25.5	25.2	31.9	42.2	48.8	33.0	42.8	43.0	32.5
8 X 9	0.6	↓	↓	8.2	↓	↓	18.4	↓	↓	26.1	↓	↓	32.0	↓	↓	24.6
9 X 10	9.7	8.4	14.9	14.9	26.9	28.4	21.1	41.3	40.7	20.4	40.6	38.2	13.6	38.7	38.7	11.6
10 X 12	42.3	↓	↓	31.4	↓	↓	18.7	↓	↓	13.2	↓	↓	6.9	↓	↓	10.0
12 X 14	29.6	71.4	68.0	22.7	46.3	41.0	12.1	28.5	29.7	5.7	13.5	11.3	4.5	10.6	10.1	6.9
14 X 16	13.5	↓	↓	11.4	↓	↓	3.3	↓	↓	1.2	↓	↓	1.5	↓	↓	2.1
16 X 20	3.3	17.6	12.9	3.1	10.0	6.7	1.1	3.3	2.2	1.0	2.6	0.7	1.8	2.2	3.2	2.5
20 X 24	0.4	↓	↓	0.8	↓	↓	0.3	↓	↓	0.3	↓	↓	1.5	↓	↓	1.8
24 X 28	-	0.7	0.3	0.1	1.2	1.5	Tr	0.9	0.9	Tr	0.8	0.3	0.8	1.5	2.2	1.1
-28	0.5	0.4	-	1.0	1.3	1.1	Tr	0.5	1.3	Tr	0.3	0.7	3.0	4.2	2.7	5.5
% Calcine Weight Change	0			-0.4			-0.2			-2.8			-.18			-1.7
% Sulfide	.0.08			0.04			0.19			0.49			0.95			1.07
Elemental Analysis, Wt %																
SiO_2	6.37			7.54			6.49			7.53			8.26			8.51
SO_3	0.51			0.25			0.98			2.60			4.41			4.81
Na_2O	0.10			0.13			0.14			0.44			0.55			0.50

Table 39-4. CALCINED CIRCULATED ACCEPTOR (Sheet 1 of 2)

Date	← 9/30/76 →				← 10/1/76 →			← 10/2/76 →					← 10/3/76 →		
Time	0000	0350	0800	1600	0000	0830	1600	0000	0800	1200	1600	2000	0000	0400	0800
Screen Size, Wt % Tyler Mesh															
+6	↓	1.4	1.1	↓	↓	1.6	↓	↓	↓	↓	1.8	↓	2.2	2.5	2.3
6 X 8	38.1	31.3	24.4	40.2	32.1	30.9	39.1	37.6	59.8	44.4	41.6	34.6	42.1	48.7	40.8
8 X 9	↓	24.4	35.7	↓	↓	24.4	↓	↓	↓	↓	20.6	↓	26.6	23.4	27.8
9 X 10	38.0	12.0	18.2	33.9	41.6	15.5	36.8	40.5	38.2	33.2	13.5	32.4	11.5	11.7	13.9
10 X 12	↓	9.6	7.2	↓	↓	8.9	↓	↓	↓	↓	8.0	↓	6.2	4.8	6.8
12 X 14	13.6	6.3	4.7	12.4	17.4	5.8	16.4	12.7	1.6	18.6	4.3	17.2	4.0	2.5	3.6
14 X 16	↓	2.6	1.7	↓	↓	2.8	↓	↓	↓	↓	1.9	↓	1.5	1.3	1.1
16 X 20	4.1	3.1	1.9	3.4	4.5	2.9	3.5	4.7	0.1	1.7	1.9	5.2	1.6	1.6	1.3
20 X 24	↓	2.2	1.7	↓	↓	1.9	↓	↓	↓	↓	1.1	↓	1.0	1.0	0.7
24 X 28	2.3	1.3	1.0	3.9	3.0	1.3	14.7	1.8	0.0	0.8	0.6	3.0	0.6	0.4	0.3
-28	3.4	5.8	2.4	5.6	1.4	4.0	2.8	2.6	0.2	1.1	4.7	7.5	2.7	2.1	1.4
% Calcine Weight Change		-2.4	+1.1			+0.2					+2.2		+3.1	+2.3	+2.6
% Sulfide		1.32	1.33			1.52					1.03		1.10	1.20	1.26
Elemental Analysis, Wt %															
SiO_2		5.50	8.07			8.46					9.05		8.38	8.33	8.50
SO_3		5.64	5.82			5.70					3.89		3.52	4.46	4.72
Na_2O		0.53	0.44			0.36					0.48		0.50	0.53	0.56

Table 39-4. CALCINED CIRCULATED ACCEPTOR (Sheet 2 of 2)

Date	9/25/76	← 9/26/76 →			← 9/27/76 →			← 9/28/76 →			← 9/29/76 →				
Time	0845	1600	0000	0800	1600	0000	0800	1545	0000	0800	1600	0045	0845	1200	1600	2000
Screen Size, Wt % Tyler Mesh																
+6	↓	↓	↓	Tr	↓	↓	↓	↓	↓	0.1	↓	↓	1.5	↓	↓	1.4
6 X 8	↓	1.1	4.3	5.0	8.4	9.0	12.2	18.9	16.7	20.2	29.2	27.5	28.7	36.2	39.6	37.0
8 X 9	0.4	↓	↓	6.9	↓	↓	14.4	↓	↓	21.2	↓	↓	30.5	↓	↓	18.8
9 X 10	5.6	5.7	14.3	12.5	20.6	25.7	23.5	37.3	35.9	20.2	39.6	41.1	15.5	34.4	35.9	11.6
10 X 12	35.2	↓	↓	29.0	↓	↓	22.6	↓	↓	17.2	↓	↓	7.9	↓	↓	8.1
12 X 14	31.6	53.3	55.2	23.9	54.0	48.6	15.2	33.8	34.3	8.6	17.6	15.4	5.2	13.5	13.9	5.2
14 X 16	19.9	↓	↓	13.6	↓	↓	4.7	↓	↓	3.7	↓	↓	2.4	↓	↓	3.0
16 X 20	6.1	23.0	21.7	4.2	13.8	10.8	2.4	5.6	5.6	3.3	6.6	5.7	2.9	5.5	4.8	3.3
20 X 24	1.0	↓	↓	1.2	↓	↓	1.8	↓	↓	2.4	↓	↓	2.3	↓	↓	3.2
24 X 28	-	15.8	2.3	0.8	1.7	3.3	1.4	2.7	5.3	1.2	4.4	4.1	1.4	5.4	3.1	2.5
-28	0.2	1.1	2.2	2.8	1.5	2.7	1.9	1.7	2.2	2.0	2.6	6.3	1.6	5.1	2.7	5.9
Particle Density, lb/cu ft	188	187		143	164	150	133	129	118	116	112	109	105	106	112	107
Activity		.1		0.06	0.08	0.07	0.07	0.11	0.17	0.16	0.016	0.17	0.16	0.18	0.19	0.18
% Calcine Weight Change	-1.5			-6.7	-5.67	-5.60	-6.61	-7.76	-8.49	-8.3			-7.7		-9.4	-8.7
Elemental Analysis, Wt %																
SiO_2	4.57			4.40	5.74	8.04	6.85	6.16	6.07	8.89			10.80		10.36	12.00
SO_3	0.19			0.16	0.20	0.45	.86	1.10	1.55	2.23			4.50		5.31	3.75
Na_2O	0.18			0.08	0.15	0.19	.33	0.40	0.48	0.73			0.78		0.89	0.52
CaO	51.83			69.45			73.33			75.42			73.61			72.68
MgO	34.62			22.98			14.97			8.03			4.91			4.71
K_2O	0.02			0.02			0.04			0.05			0.05			0.04
Al_2O_3	1.14			1.57			2.17			2.91			3.72			3.40
Fe_2O_3	1.44			1.36			1.62			1.97			2.32			2.24
P_2O_5	0.02			0.03			0.04			0.04			0.04			0.04
TiO_2	0.07			0.08			0.06			0.10			0.15			0.16

Table 39-5. RECARBONATED CIRCULATED ACCEPTOR (Sheet 1 of 2)

Date	← 9/30/76 →				← 10/1/76 →			← 10/2/76 →					← 10/3/76 →		
Time	0000	0400	0800	1600	0000	0300	1600	0030	0800	1200	1600	1950	0000	0345	0800
Screen Size, Wt % Tyler Mesh															
+6	+	1.3	1.3	+	+	0.8	+	+	1.0	+	1.2	+	1.3	1.3	1.4
6 X 8	28.9	35.0	35.7	30.7	22.7	19.4	30.8	28.8	29.8	32.0	34.0	40.9	38.0	37.2	33.9
8 X 9	+	19.9	18.9	+	+	25.3	+	+	26.6	+	21.9	+	23.0	23.1	24.2
9 X 10	26.2	12.2	11.6	32.8	35.2	15.5	33.1	38.4	16.2	35.5	12.0	28.0	11.9	11.3	11.8
10 X 12	+	8.7	7.5	+	+	12.7	+	+	9.0	+	9.3	+	7.6	7.7	7.8
12 X 16	12.4	5.8	5.0	14.7	19.0	7.4	19.1	16.5	5.6	17.6	6.2	16.0	4.6	4.8	5.1
16 X 20	+	4.0	4.4	+	+	4.1	+	+	3.0	+	3.3	+	2.8	3.0	3.3
20 X 24	9.9	3.7	4.1	5.7	7.2	3.8	8.0	7.2	2.9	5.5	3.2	6.9	2.9	3.2	3.6
24 X 28	+	3.0	3.4	+	+	1.2	+	+	2.0	+	1.7	+	2.3	2.6	2.9
-28	11.0	2.4	3.9	7.8	7.5	1.2	4.2	5.0	1.5	4.5	1.3	4.4	2.0	2.4	2.7
	11.5	4.0	4.2	8.3	8.4	8.6	4.8	4.0	2.3	5.0	5.9	3.9	3.6	3.4	3.2
Particle Density, lb/cu ft	110		111	114	112	117	114	112	115	118	111	113	110	112	111
Activity	0.19		0.13	0.19	0.18	0.16	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.18
% Calcine Weight Change	-8.2		-8.0	-8.0		-7.2		-8.3	-9.2		-9.1		-8.6	-8.2	
Elemental Analysis, Wt %															
SiO_2	12.64		12.95	10.06	12.36	10.46	10.83	13.95	8.83		10.71		8.38	9.07	9.55
SO_3	4.35		4.75	6.38	5.97	5.75	4.70	3.08	4.22		3.79		4.35	2.94	5.21
Na_2O	0.69		0.69	0.63	0.62	0.56	0.60	0.53	0.87		0.66		0.56	2.21	0.99
CaO			72.33			72.63			77.50		70.85		79.54	78.75	
MgO			3.63			3.22			2.34		2.20		2.14	2.24	
K_2O			0.03			0.04			0.05		0.06		0.03	0.04	
Al_2O_3			3.71			3.70			3.90		3.24		2.74	2.79	
Fe_2O_3			2.33			2.60			2.07		2.08		1.95	1.88	
P_2O_5			0.05			0.04			0.03		0.04		0.05	0.04	
TiO_2			0.15			0.23			0.17		0.15		0.10	0.11	

Table 39-5. RECARBONATED CIRCULATED ACCEPTOR (Sheet 2 of 2)

Date	9/23/76				← 9/24/76 →								9/25/76	
Time	1130		1610		0800		1200		1600		2000		0035	
Sample	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.
Screen Size, Wt % Tyler Mesh														
+8	↓	↓		↓	↓	↓	↓	↓	0.1	↓	↓	↓	↓	↓
8 X 9	↓	3.2	↓	1.6	↓	2.2	↓	2.2	↓	↓	↓	1.0	↓	1.1
9 X 10	0.6	↓	1.5	↓	1.7	↓	1.5	↓	0.7	↓	1.2	↓	1.1	
10 X 12	↓	35.5	↓	32.7	↓	34.8	↓	34.1	↓	30.0	↓	34.3	↓	35.9
12 X 14	13.1	19.4	25.2	19.7	21.2	15.2	15.9	18.7	14.9	18.0	24.4	19.2	22.3	19.7
14 X 20	10.2	16.1	14.5	21.3	11.8	19.6	11.2	13.2	10.4	16.0	12.9	18.2	13.9	20.7
20 X 28	9.2	6.5	9.0	3.3	7.6	4.3	8.5	6.6	6.8	6.0	5.9	4.0	7.5	4.3
28 X 35	14.8	↓	14.2	↓	15.6		18.0	↓	18.8	↓	12.6	↓	13.9	↓
35 X 48	25.2	↓	13.7	↓	15.7	↓	17.2	↓	18.4	↓	14.5	↓	14.2	↓
48 X 65	9.4	19.4	8.2	16.4	9.7	21.7	9.8	24.2	10.7	30.0	9.1	21.2	8.8	16.3
65 X 80	↓		↓		↓	2.2	↓	1.1	↓		↓	1.0	↓	1.1
80 X 100	6.8		5.8		7.0		6.7		7.8		7.2	↓	6.7	↓
100 X 200	7.0		5.7		7.1		6.4		7.8		7.8	↓	7.0	↓
-200	3.7		2.4		2.6		1.8		3.5		4.6	1.0	4.6	1.1
% Char	70.3		53.0		52.6		56.5		64.3		56.0		54.3	
% Ash + SO_3 in Char	20.7		27.2		30.1		26.2		28.6		24.3		23.3	
Ash Elemental Analysis, Wt % SiO_2 SO_3														

Table 39-6. GASIFIER CHAR BED MATERIAL (Sheet 1 of 8)

Date	← 9/25/76 →												9/26/76	
Time	0400		0845		1230		1600		2000		2400		0800	
Sample	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.
Screen Size, Wt % Tyler Mesh														
+8	0.1			↓	0.3	↓	0.6	↓	0.7	↓	1.3	↓	2.3	↓
8 X 9	↓		↓	2.2	↓	4.0	↓	3.4	↓	5.8	↓	10.6	↓	11.1
9 X 10	1.0	↓	2.2	↓	3.9	↓	3.3	↓	5.3	↓	4.8	↓	6.6	↓
10 X 12	↓	28.6	↓	33.3	↓	32.0	↓	34.5	↓	36.9	↓	39.8	↓	39.4
12 X 14	20.1	21.4	20.1	17.8	30.7	22.0	29.7	20.7	27.8	19.4	29.0	18.6	26.4	18.8
14 X 20	13.7	23.8	13.0	22.2	16.4	20.0	15.8	20.7	14.1	18.4	10.8	16.8	11.9	16.3
20 X 28	8.2	4.8	7.9	4.4	7.0	6.0	5.1	5.2	6.3	3.9	4.6	3.5	5.9	3.8
28 X 35	13.5	↓	13.7	↓	11.2	↓	10.4	↓	11.6	↓	8.3	↓	10.3	↓
35 X 48	16.7	↓	15.5	↓	11.9	↓	13.5	↓	14.1	↓	17.2	↓	14.3	↓
48 X 65	9.0	21.4	9.3	20.0	7.6	16.0	9.4	15.5	9.1	13.6	9.9	10.6	8.9	10.6
65 X 80	↓		↓		↓		↓		↓	1.0	↓		↓	
80 X 100	6.6		6.8		5.7		7.0		6.7	↓	7.8		6.9	
100 X 200	6.8		7.3		4.2		4.3		3.8	↓	5.6		4.6	
-200	4.3		4.1		1.1		0.9		0.5	1.0	0.5		1.9	
% Char	57.0		57.4		48.0		55.0		49.5		45.3		44.5	
% Ash + SO_3 in Char	25.4		25.2		20.3		17.4		13.4		14.4		15.0	
Ash Elemental Analysis, Wt %														
SiO_2			33.4										18.2	
SO_3			25.2										2.1	

Table 39-6. GASIFIER CHAR BED MATERIAL (Sheet 2 of 8)

Date	← 9/26/76 →						← 9/27/76 →							
Time	1215		1600		2000		0010		0400		0830		1200	
Sample	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.
Screen Size, Wt % Tyler Mesh														
+8	4.2	↓	4.2	↓	4.0	↓	4.4	↓	6.2	↓	6.6	↓	4.9	↓
8 X 9	↓	14.8	↓	21.2	↓	20.2	↓	27.5	↓	24.6	↓	27.1	↓	27.6
9 X 10	10.5	↓	11.2	↓	9.5	↓	9.5	↓	12.2	↓	13.7	↓	14.2	↓
10 X 12	↓	37.0	↓	36.3	↓	34.8	↓	32.5	↓	36.8	↓	32.2	↓	32.8
12 X 14	26.3	16.7	20.1	13.8	23.2	13.5	19.8	11.7	23.6	11.4	19.0	10.2	16.7	8.6
14 X 20	9.5	16.7	9.1	11.3	10.0	12.4	7.3	9.2	8.2	8.8	5.8	10.2	5.2	10.3
20 X 28	6.0	3.7	8.0	6.3	6.3	5.6	7.4	0.8	7.9	6.1	7.3	6.8	7.2	6.9
28 X 35	12.0	↓	13.2	↓	12.4	↓	14.2	↓	13.3	↓	9.3	↓	12.8	↓
35 X 48	13.4	↓	14.2	↓	14.4	↓	15.7	↓	13.3	↓	18.6	↓	16.1	↓
48 X 65	8.6	11.1	9.6	11.3	9.4	13.5	10.1	17.5	7.7	12.3	9.3	13.6	10.5	13.8
65 X 80	↓		↓		↓		↓	0.8	↓		↓		↓	
80 X 100	6.0		6.7		6.7		7.3		5.0		6.3		7.4	
100 X 200	3.2		3.4		3.6		3.9		2.6		3.7		4.7	
-200	0.4		0.4		0.4		0.6		0.2		0.3		0.4	
% Char	47.1		58.5		48.3		54.1		42.9		49.1		56.1	
% Ash + SO_3 in Char	10.2		12.8		10.4		8.4		13.5		14.6		12.8	
Ash Elemental Analysis, Wt % SiO_2 SO_3											15.4 5.2			

Table 39-6. GASIFIER CHAR BED MATERIAL (Sheet 3 of 8)

Date	← 9/27/76 →				← 9/28/76 →									
Time	1500		2000		0000		0440		0800		1200		1600	
Sample	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.
Screen Size, Wt %														
Tyler Mesh														
+8	7.4	↓	8.4	↓	6.6	↓	8.4	↓	9.1	↓	12.1	↓	10.1	↓
8 X 9	↓	30.7	↓	34.8	↓	35.5	↓	37.0	↓	24.3	↓	42.7	↓	41.7
9 X 10	14.8	↓	18.6	↓	13.7	↓	16.6	↓	15.8	↓	17.3	↓	18.4	↓
10 X 12	↓	34.6	↓	32.4	↓	31.2	↓	28.8	↓	32.4	↓	25.3	↓	23.3
12 X 14	20.2	8.7	16.3	7.2	16.7	6.5	15.5	5.5	16.7	5.4	11.5	4.0	10.6	4.8
14 X 20	6.4	8.7	5.0	8.4	4.7	8.6	6.1	9.6	4.9	10.8	4.6	8.0	6.0	9.7
20 X 28	6.8	6.3	6.5	6.0	5.1	6.5	6.8	6.8	7.8	8.1	6.0	6.7	7.9	5.8
28 X 35	10.7	↓	11.2	↓	13.4	↓	3.5	↓	0.7	↓	4.2	↓	10.6	↓
35 X 48	12.9		12.9		16.1		21.2		26.7		22.6		15.4	
48 X 65	8.5	11.0	9.1	10.8	9.7	11.8	8.5	12.3	8.7	18.9	9.6	13.3	8.8	14.6
65 X 80	↓		↓		↓		↓		↓		↓		↓	
80 X 100	6.3		6.3		6.9		6.1		5.8		7.0		6.3	
100 X 200	4.2		3.4		4.9		4.4		3.8		4.5		4.3	
-200	1.9		2.3		2.4		2.8		0.2		0.6		1.6	
% Char	48.1		51.7		51.4		51.9		56.6		51.2		53.2	
% Ash + SO_3 in Char	15.6		15.3		15.8		15.3		16.0		16.2		20.8	
Ash Elemental Analysis, Wt %														
SiO_2									13.8					
SO_3									7.7					

Table 39-6. GASIFIER CHAR BED MATERIAL (Sheet 4 of 8)

Date	9/28/76		← 9/29/76 →											
Time	2000		0000		0400		0820		1200		1545		2000	
Sample	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.
Screen Size, Wt % Tyler Mesh														
+8	9.2	↓	9.4	↓	8.6	↓	14.6	↓	18.2	↓	7.8	↓	16.2	↓
8 X 9	↓	43.1	↓	36.1	↓	43.5	↓	46.7	↓	47.0	↓	28.7	↓	55.3
9 X 10	16.5	↓	15.0	↓	12.7	↓	19.2	↓	21.8	↓	15.4	↓	20.8	↓
10 X 12	↓	17.4	↓	18.0	↓	15.9	↓	18.3	↓	18.1	↓	14.9	↓	16.1
12 X 14	9.5	4.6	12.6	3.3	11.9	2.9	9.9	3.3	12.2	3.6	10.3	2.3	15.5	4.0
14 X 20	4.6	7.3	6.1	11.5	5.8	8.7	4.6	8.3	4.7	8.4	5.5	8.0	5.5	6.5
20 X 28	7.5	6.4	8.2	9.8	7.3	8.7	6.0	8.3	6.5	7.2	5.2	20.7	6.3	6.5
28 X 35	6.1	↓	1.8	↓	10.5	↓	3.4	↓	0.7	↓	2.6	↓	6.8	↓
35 X 48	21.4	↓	26.8	↓	19.6	↓	21.6	↓	20.6	↓	28.8	↓	14.4	↓
48 X 65	10.1	18.3	8.3	21.3	8.8	20.3	7.8	15.0	6.1	15.7	8.5	25.3	5.5	10.6
65 X 80	↓	1.8	↓		↓		↓		↓		↓	Tr	↓	0.5
80 X 100	7.1	↓	6.0		6.9		6.2		4.7		6.7		4.1	↓
100 X 200	5.4	↓	4.2		5.6		5.1		3.8		5.6		3.4	↓
-200	2.2	0.9	1.4		2.3		1.7		0.7		3.4		1.4	0.5
% Char	42.8		54.0		56.4		46.6		42.5		49.7		28.8	
% Ash + SO_3 in Char	17.3		18.3		17.2		17.3		17.7		20.9		12.1	
Ash Elemental Analysis, Wt %														
SiO_2							15.6				16.1		13.6	
SO_3							11.5				11.7		15.2	

Table 39-6. GASIFIER CHAR BED MATERIAL (Sheet 5 of 8)

Date	← 9/30/76 →										10/1/76			
Time	0000		0400		0800		1200		1608		0000		0410	
Sample	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.
Screen Size, Wt %														
Tyler Mesh														
+8	9.5	↓	12.4	↓	10.7	↓	13.4	↓	17.8	↓	8.7	↓	10.5	↓
8 X 9	↓	42.6	↓	40.8	↓	45.5	↓	43.8	↓	45.0	↓	37.9	↓	37.8
9 X 10	16.0	↓	16.8	↓	15.3	↓	21.8	↓	25.1	↓	13.7	↓	16.9	↓
10 X 12	↓	14.8	↓	17.3	↓	15.7	↓	19.7	↓	21.0	↓	18.4	↓	20.3
12 X 14	12.5	3.0	12.3	4.1	11.2	4.5	13.3	5.0	15.0	5.0	10.7	5.8	13.5	5.4
14 X 20	5.7	8.9	6.7	9.2	5.3	9.0	7.0	8.4	7.1	10.0	6.3	10.3	7.6	10.1
20 X 28	6.5	9.9	7.0	9.2	6.5	8.2	6.2	7.9	5.7	7.0	7.8	9.2	6.5	8.1
28 X 35	3.0	↓	4.6	↓	8.1	↓	2.6	↓	1.6	↓	1.9	↓	4.7	↓
35 X 48	23.6	↓	20.1	↓	21.9	↓	19.7	↓	16.2	↓	26.3	↓	18.8	↓
48 X 65	7.7	20.8	7.3	18.4	8.0	16.4	6.5	15.2	4.5	12.0	9.7	18.4	8.1	17.6
65 X 80	↓	Tr	↓	1.0	↓	0.7	↓	Tr	↓	Tr	↓	Tr	↓	0.7
80 X 100	6.2		5.9		6.9		5.2		3.6		7.8		6.4	
100 X 200	4.5		4.6		4.9		3.5		2.4		5.3		4.7	
-200	1.7		2.2		1.1		0.9		0.9		1.8		2.2	
% Char	57.6		41.1		41.9				37.6		46.0		39.8	
% Ash + SO_3 in Char	17.0		19.0		16.6				15.4		16.0		17.7	
Ash Elemental Analysis, Wt %														
SiO_2			22.8											
SO_3			4.7											

Table 39-6. GASIFIER CHAR BED MATERIAL (Sheet 6 of 8)

Date	← 10/1/76 →								← 10/2/76 →					
Time	0800		1200		1600		2005		0030		0400		0800	
Sample	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.
Screen Size, Wt % Tyler Mesh														
+8	10.3	↓	9.9		13.3	↓	8.3	↓	9.4	↓	11.6	↓	9.9	↓
8 X 9	↓	41.5	↓		↓	45.0	↓	45.1	↓	43.2	↓	44.3	↓	39.6
9 X 10	18.1	↓	18.1		22.2	↓	17.6	↓	15.3	↓	18.3	↓	15.0	↓
10 X 12	↓	17.1	↓		↓	21.0	↓	21.6	↓	17.9	↓	16.5	↓	16.2
12 X 14	13.0	5.7	15.0		17.3	5.0	15.2	4.9	11.1	4.2	10.6	3.8	11.4	3.6
14 X 20	7.1	9.8	6.0		7.0	8.0	7.3	7.8	4.8	8.4	6.6	7.6	7.0	8.1
20 X 28	5.9	8.9	2.9		5.9	6.0	5.9	5.9	6.9	7.4	8.1	7.6	8.0	9.0
28 X 35	5.0	↓	9.4		5.0	↓	4.1	↓	4.5	↓	11.6	↓	8.3	↓
35 X 48	20.1	↓	18.8		15.3	↓	23.8	↓	25.8	↓	16.1	↓	21.3	↓
48 X 65	8.3	17.1	8.0		5.8	15.0	7.2	19.7	9.4	18.9	8.1	20.3	8.6	22.5
65 X 80	↓	Tr	↓		↓	Tr	↓		↓		↓		↓	0.9
80 X 100	6.6		6.2		4.2		5.1		6.9		5.0		6.4	
100 X 200	4.2		4.0		2.7		3.3		4.6		2.9		3.0	
-200	1.3		1.6		1.2		2.2		1.2		1.0		0.9	
% Char	40.1				36.3		38.2		46.6		43.1		46.7	
% Ash + SO_3 in Char	18.0				16.4		16.6		15.6		15.4		16.2	
Ash Elemental Analysis, Wt % SiO_2 SO_3	16.7 18.0													

Table 39-6. GASIFIER CHAR BED MATERIAL (Sheet 7 of 8)

Date	← 10/2/76 →						← 10/3/76 →					
Time	1200		1600		1955		0000		0345		0800	
Sample	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.	Mix	Acc.
Screen Size, Wt % Tyler Mesh												
+8	15.0	↓	12.5	↓	9.5	↓	11.9	↓	13.6	↓	10.0	↓
8 X 9	↓	49.1	↓	43.6	↓	43.0	↓	49.5	↓	43.1	↓	44.4
9 X 10	16.7	↓	15.5	↓	11.6	↓	15.8	↓	15.8	↓	12.2	↓
10 X 12	↓	17.0	↓	15.4	↓	13.9	↓	14.3	↓	15.7	↓	14.5
12 X 14	13.0	3.6	8.8	3.8	8.5	2.5	9.2	3.8	8.0	3.9	9.8	4.0
14 X 20	6.8	7.1	4.1	7.7	3.8	7.6	6.4	6.7	4.7	7.8	7.6	8.1
20 X 28	7.0	6.3	4.1	7.7	7.1	8.9	8.0	7.6	7.8	9.8	9.9	10.5
28 X 35	1.9	↓	2.4	↓	6.8	↓	9.0	↓	6.9	↓	6.4	↓
35 X 48	25.7	↓	31.4	↓	25.7	↓	20.7	↓	21.9	↓	24.3	↓
48 X 65	3.2	17.0	4.1	21.8	7.0	24.1	5.1	18.1	7.1	19.6	9.1	18.5
65 X 80	↓	Tr	↓	Tr	↓	0	↓	0	↓	0	↓	0
80 X 100	8.3		11.8		12.6		9.2		8.5		6.2	
100 X 200	1.8		3.7		5.5		3.7		4.5		3.5	
-200	0.6		1.6		2.0		1.0		1.3		0.9	
% Char	48.2		46.6		51.1		46.1		55.2		48.7	
% Ash + SO_3 in Char	15.5		15.8		14.7		15.3		13.6		7.8	
Ash Elemental Analysis, Wt %												
SiO_2	13.0						12.7		12.7			
SO_3	11.6						13.1		9.4			

Table 39-6. GASIFIER CHAR BED MATERIAL (Sheet 8 of 8)

Date	9/25/76		← 9/26/76 →				9/27/76		9/28/76		9/29/76
Time	0600	1920	0100	0900	1700	2140	0215	2200	0440	2045	0600
Screen Size, Wt %											
Tyler Mesh											
+35	0.8	0.9	0	0.3	0.1	0.3	0	2.5	0.1	0	Tr
35 X 48	0.4	0.7	0.3	0.3	0.5	0.2	0.2	4.5	0.3	0.3	0.5
48 X 65	0.4	2.8	0.9	1.5	1.0	0.8	0.6	7.8	0.5	0.9	0.7
65 X 100	0.8	11.9	4.0	6.2	4.3	4.7	3.4	10.8	3.9	4.0	2.1
100 X 200	24.2	18.6	26.1	29.5	28.8	31.8	24.9	22.1	23.5	26.8	16.2
200 X 325	49.8	41.4	20.2	40.1	16.7	18.6	13.2	15.8	16.2	18.3	14.3
-325	23.6	23.7	48.4	22.1	48.7	43.6	57.6	36.5	55.4	49.7	66.3
Ultimate Analysis, Wt %											
Moisture	1.62		.47	.44			0.95		0.54		
C	51.32			69.44			70.86	4.31	67.54		
H + Moisture H	0.89			0.99			0.99	0.15	0.97		
N	0.31			0.20			0.21	0.03	0.26		
Total S	1.09			0.51			0.49	1.97	0.66		
Ash + SO_3	45.94		25.19	24.66			23.43	95.00	26.50		
Elemental Analysis, Wt %											
SiO_2	32.64			19.60			19.42	16.33	16.97		
SO_3	5.72			5.08			5.21	6.18	6.05		
Na_2O	2.46			1.57			3.75	1.51	5.92		
CaO	28.46			52.84			47.72	62.69	48.47		
MgO	8.66			8.53			6.74	4.90	5.98		
K_2O	0.47			0.36			0.56	0.41	1.11		
Al_2O_3	12.76			10.83			10.11	4.96	9.02		
Fe_2O_3	8.22			6.16			7.01	2.85	7.45		
P_2O_5	0.04			0.08			0.06	0.09	0.04		
TiO_2	0.54			0.31			0.46	0.25	0.45		

Table 39-7. GASIFIER CYCLONE SOLIDS ANALYSIS (Sheet 1 of 2)

Date	9/29/76	← 9/30/76 →			← 10/1/76 →			10/2/76		10/3/76	
Time	1845	0400	1200	1900	0300	1015	1730	0245	1000	0145	1100
Screen Size, Wt %											
Tyler Mesh											
+35	1.1	Tr	0.1	0.1	Tr	0.4	0.5	0	0	0.3	Tr
35 X 48	1.1	0.3	0.6	0.3	0.2	0.4	0.8	0.7	0.1	0.8	0.3
48 X 65	1.3	0.6	1.3	0.9	0.7	1.2	1.1	1.1	0.2	1.3	1.1
65 X 100	3.8	3.5	7.2	5.7	6.3	8.0	5.2	6.2	5.7	6.7	6.5
100 X 200	22.3	25.3	34.0	30.3	34.6	33.4	26.9	28.7	30.5	29.0	33.5
200 X 325	15.3	16.7	17.0	16.2	23.0	18.8	14.8	15.3	14.7	18.2	18.7
-325	55.2	53.6	39.8	46.5	35.1	37.8	50.8	48.0	48.8	43.7	39.9
Ultimate Analysis, Wt %											
Moisture	0.59	0.21		0.46	3.17				0.34	0.35	
C	61.06	65.66		66.71	65.86				65.20	54.93	
H + Moisture H	0.89	0.80		0.87	1.03				0.81	0.74	
N	0.23	0.25		0.26	0.24				0.24	0.39	
Total	0.58	0.43		0.43	0.47				0.53	0.48	
Ash + SO_3	33.89	28.54		27.18	27.41				29.12	25.76	
Elemental Analysis, Wt %											
SiO_2	19.59	20.84		18.49	18.94				17.55	17.92	
SO_3	5.03	4.03		4.15	4.17				5.03	5.16	
Na_2O	5.75	7.20		6.59	6.54				5.98	6.29	
CaO	47.39	46.00		47.73	48.07				50.46	49.42	
MgO	5.30	5.10		5.37	5.52				6.01	6.05	
K_2O	1.10	0.90		0.75	0.94				0.87	1.07	
Al_2O_3	8.75	9.17		9.17	9.47				8.61	8.35	
Fe_2O_3	6.88	7.56		7.86	7.26				6.69	7.10	
P_2O_5	0.05	0.05		0.05	0.05				0.05	0.04	
TiO_2	0.41	0.41		0.46	0.41				0.40	0.48	

Table 39-7. GASIFIER CYCLONE SOLIDS ANALYSIS (Sheet 2 of 2)

Date	9/25/76	9/26/76	9/27/76	9/28/76	9/29/76	9/30/76	10/1/76
Ultimate Analysis, Wt %							
C	47.08	72.25	74.20	73.27	70.24	70.80	68.20
H	1.36	1.16	1.16	1.11	1.27	1.31	1.01
N	0.26	0.28	0.27	0.27	0.28	0.37	0.25
S	0.73	0.77	0.63	0.77	0.70	0.85	0.72
Ash + SO_3	31.87	21.56	19.83	20.37	22.35	21.17	23.46
Elemental Analysis, Wt %							
SiO_2	26.88	20.27	27.61	20.80	23.75	23.19	15.34
SO_3	5.59	8.56	8.92	10.07	9.06	10.66	6.72
Na_2O	1.48	1.75	3.25	4.15	4.19	3.35	1.85
CaO	38.33	45.11	35.84	40.42	39.02	40.24	57.73
MgO	4.95	5.22	3.84	3.66	3.60	3.60	2.32
K_2O	0.22	0.27	0.40	0.60	0.63	0.69	0.40
Al_2O_3	13.12	11.18	11.17	10.55	10.41	10.16	9.33
Fe_2O_3	8.59	7.16	9.10	9.66	8.91	7.74	6.84
P_2O_5	0.41	0.84	0.31	0.22	0.24	0.23	0.12
TiO_2	0.57	0.39	0.46	0.51	0.43	0.46	0.40

Table 39-8. GASIFIER QUENCH TOWER SOLIDS

Date	9/25/76	9/26/76	9/27/76	9/23/76	9/29/76		9/30/76		10/1/76	10/2/76		← 10/3/76 →		
Time	0430	0920	1100	0800	1130	1745	0550	1630	0935	0630	1700	0030	0345	0718
Screen Size, Wt %														
Tyler Mesh														
+6			0.1	0.2	1.3	1.5	1.5	1.1	0.9	1.0	1.2	4.5	5.5	21.9
6 X 8	0.2	2.8	12.1	23.5	28.7	34.0	33.1	26.2	22.0	27.4	30.5	35.0	40.0	23.8
8 X 9	0.4	5.2	15.1	21.7	32.9	26.2	24.8	24.8	25.6	28.5	23.7	22.5	21.2	22.0
9 X 10	8.0	13.3	23.8	22.0	18.4	14.9	14.1	17.1	17.7	17.5	14.6	14.8	13.8	14.4
10 X 12	32.4	34.4	25.6	15.9	7.5	9.2	8.9	12.1	11.5	9.7	10.4	8.4	7.0	6.7
12 X 14	31.0	25.8	16.4	8.6	4.4	5.3	5.2	7.8	7.4	5.6	6.0	4.5	4.0	3.9
14 X 16	20.5	12.9	3.2	2.7	1.7	1.7	2.3	2.9	4.1	2.9	3.4	2.2	1.7	1.3
16 X 20	5.3	3.5	1.8	2.6	1.7	1.6	2.1	2.3	3.3	2.3	2.8	2.6	2.6	1.9
20 X 24	1.2	0.8	1.0	1.4	1.1	1.2	2.0	1.8	2.3	1.5	1.7	1.8	1.2	1.1
24 X 28	0.5	0.3	0.3	0.4	0.5	0.9	1.1	1.3	1.7	1.1	1.2	1.1	0.9	0.8
-28	0.5	1.0	0.6	0.9	1.5	3.4	4.9	3.4	3.5	2.5	4.5	2.6	2.1	2.2
Elemental Analysis, Wt %														
SiO_2	6.41	7.48	6.96	8.69	9.20	10.02	7.74	10.06	10.86	8.49	8.92	8.89	9.00	8.97
SO_3	0.52	0.24	1.00	2.61	5.03	5.00	5.99	5.75	5.37	3.74	4.23	3.93	3.92	4.55
Na_2O	0.11	0.11	0.22	0.58	0.69	0.57	0.59	0.55	0.49	0.52	0.48	0.60	0.56	0.56
CaO	55.30	71.36	77.30	76.62	75.01	75.10	75.14	73.80	73.00	78.00	78.18	78.45	79.43	79.12
MgO	34.13	16.92	9.62	6.30	3.40	3.64	3.15	3.19	3.26	2.60	2.66	2.73	2.40	2.36
K_2O	0.02	0.02	0.04	0.05	0.05	0.04	0.04	0.03	0.04	0.04	0.04	0.04	0.04	0.04
Al_2O_3	1.80	2.30	2.91	3.18	3.84	3.89	4.30	3.85	4.07	4.05	3.14	3.08	2.83	3.01
Fe_2O_3	1.83	1.50	1.70	1.86	2.56	2.49	2.70	2.49	3.04	2.22	2.08	1.94	2.06	2.04
P_2O_5	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.04	0.02	0.02
TiO_2	0.10	0.11	0.14	0.15	0.18	0.20	0.20	0.20	0.20	0.20	0.02	0.15	0.14	0.14

Table 39-9. REGENERATOR PURGED ACCEPTOR

Date	9/25/76	9/26/76	9/27/76	9/28/76	9/29/76	9/30/76	10/1/76	10/2/76	10/3/76
Screen Size, Wt %									
Tyler Mesh									
+35	2.9	2.1	2.5	1.7	4.0	6.9	5.7	3.6	2.6
35 X 48	7.4	4.7	4.5	7.6	9.5	14.4	12.7	14.5	8.7
48 X 65	10.1	7.4	7.8	10.1	9.3	11.7	13.5	13.0	10.6
65 X 100	13.1	10.7	10.8	14.9	12.6	13.7	16.2	17.3	13.8
100 X 200	26.8	22.7	22.1	26.2	23.5	21.5	22.2	21.7	15.8
200 X 325	14.8	17.3	15.8	15.2	14.0	11.6	10.2	10.4	16.4
-325	24.9	35.1	36.5	24.3	27.1	20.2	19.5	19.5	32.1
Ultimate Analysis, Wt %									
C	5.53	5.31	4.31	4.75	3.28	3.61	3.01	5.59	3.46
H	0.14	0.16	0.15	0.12	0.10	0.11	0.08	0.17	0.10
N	0.05	0.04	0.03	0.01	0.03	0.02	0.02	0.01	0.01
Total S	1.65	2.22	1.97	1.81	1.99	1.61	2.05	2.27	1.65
Ash + SO_3	93.04	95.34	95.00	95.62	95.18	97.01	95.68	96.12	96.55
Elemental Analysis, Wt %									
SiO_2	35.33	20.72	16.33	19.45	21.01	20.01	22.99	21.59	22.11
SO_3	3.47	4.95	6.18	6.04	6.21	6.34	5.42	6.36	5.00
Na_2O	1.49	1.00	1.51	2.36	2.05	1.98	1.97	1.72	2.27
CaO	38.42	60.04	62.69	61.22	61.06	60.98	60.48	61.26	61.31
MgO	10.33	5.75	4.90	4.30	2.89	2.69	2.66	2.19	2.62
K_2O	0.54	0.42	0.41	0.39	0.35	0.37	0.37	0.38	0.46
Al_2O_3	5.68	4.64	4.96	4.24	3.79	4.36	4.02	3.90	3.71
Fe_2O_3	5.38	2.84	2.85	2.59	2.73	2.99	2.72	2.21	2.24
P_2O_5	0.09	0.10	0.09	0.07	0.06	0.06	0.05	0.06	0.06
TiO_2	0.30	0.14	0.25	0.26	0.25	0.37	0.27	0.24	0.27

Table 39-10. REGENERATOR ASH AND ATTRITED ACCEPTOR DAILY COMPOSITES

Date				9/27/76		← 9/28/76 →			← 9/29/76 →		
Time				1105	1925	0310	1310	1855	0430	1110	1930
dPR*	Chart	Zero	Range In. W.C.	Chart Readings							
2030	-10/10	9.0	554.0	3.0	2.8	2.9	3.0	3.0	2.0	1.3	1.3
2089	0/100	4.2	25	41	25	24	33	33	61	55	50
2088	0/100	3.0	168.7	31	29	29	28	27	29	32	35
2087	0/100	3.0	43.7	64	63	64	62	57	60	69	75
2094	0/100	3.0	53.9	63	62	60	60	57	60	70	73
2093	0/100	3.0	115.4	33	34	32.5	31.5	29	31.5	35	37.5
2001	0/100	3.0	126.2	18	17.5	17	17	16	17	20	22
2002	0/100	3.0	57.1	36	34	33	33	30	29	29	30
2083	0/100	3.0	57.7	49	47	47	52	42	42	42	43
2019	0/100	4.2	300.0	25	28	24	18	20	17	16	15
2037	-10/10	9.0	100.0	-0.8	-0.8	-0.8	-0.8	-1.2	-0.8	-0.7	-0.6
2021	0/100	4.2	50.0	80	79	80	84	80	75	75	70
2022	0/100	4.8	25.0	60	57	57	58	58	49	45	45
2073	0/100	3.0	150.0	32	31	30	29	28	27	27	27
2074	0/100	3.0	180.0	48	47	45	43	40	40	40	40
2075	0/100	3.0	180.0	53	53	52	49	48	43	42	44
2076	0/100	3.0	144.0	39	38	36	35	33	30	31	31
2077	0/100	3.0	144.0	18	21	22	23	22	15	16	17
2024	0/100	4.2	93.6	42	41	42	43	42	35	33	33
2025	0/100	4.2	300.0	23	22	23	23	22	17	14	13
2026	-10/10	9.0	40.0	-1.2	-1.4	-1.3	-1.4	-1.4	-1.5	-4.2	-3.0
2102	0/100	4.2	100.0	56	56	56	55	53	53	60	56
2020	0/100	4.2	300.0	47	51	48	46	42	42	47	50
2036	-10/10	9.0	100.0	-1.8	-1.9	-1.9	-1.9	-1.9	-2.0	-1.9	-2.0
2028	0/100	4.8	50.0	70	75	75	74	75	75	81	85
2080	-2/2	9.0	40.0	69	68	67	71	70	72	73	75

Location*	Pressure, In. W.C.**							
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	62.38	54.87	54.43	55.03	54.49	64.44	66.85	69.42
3	162.77	155.52	153.85	154.37	145.91	160.29	176.82	184.45
4	234.39	224.30	222.20	227.06	208.90	223.02	243.80	253.85
5	280.63	279.53	265.99	253.26	240.88	245.53	263.46	270.19
6	276.65	275.55	261.97	249.15	234.79	241.53	259.93	267.22
7	218.09	218.30	204.91	191.11	178.05	188.63	208.35	217.20
8	168.50	170.26	158.91	147.52	135.42	146.83	166.84	174.92
9	-71.35	-66.86	-70.74	-71.51	-69.04	-46.45	-29.53	-28.45
10	-98.53	-98.42	-103.85	-106.05	-101.42	-69.18	-54.11	-54.93
11	2.41	2.80	2.59	2.79	2.85	3.03	8.33	5.85
12	115.79	108.22	107.16	105.70	103.80	114.55	123.58	123.14
13	223.42	227.82	216.47	206.94	194.46	206.60	229.86	240.46
14	214.37	218.26	207.03	197.69	185.09	196.59	220.42	230.34
15	175.73	177.10	165.43	155.81	143.21	155.30	175.77	184.48

*Refer to Figure 2.
**Static pressure at Location 1 is 150 psig.
Pressures given are differential pressures from Location 1.

Table 39-11. PRESSURE BALANCE DATA (Sheet 1 of 2)

Date				9/30/76		← 10/1/76 →			← 10/2/76 →			10/3/76
Time				0315	1240	0300	1100	1910	0345	1130	1915	0330
dPR**	Chart	Zero	Range In. W.C.	Chart Readings								
2030	-10/10	9.0	554.0	1.2	0.8	0.6	0.8	0.6	0.5	0.5	0.5	0.5
2089	0/100	4.2	25	57	21	45	58	8	46	79	44	34
2088	0/100	3.0	168.7	37	37	37	37	34	34	31	32	32
2087	0/100	3.0	43.7	75	77	75	79	76	70	66	67	65
2094	0/100	3.0	53.9	75	80	75	79	76	70	66	67	65
2093	0/100	3.0	115.4	37	41	39	40	39.5	36	35	34	33
2001	0/100	3.0	126.2	22	24	21	22	21	19	18	18	17
2002	0/100	3.0	57.1	29	29.5	30	30	31	31	31	31	31
2083	0/100	3.0	57.7	43.	43	43	43	43	42	42	42	42
2019	0/100	4.2	300.0	5	15	15	13	26	25	29	27	32
2037	-10/10	9.0	100.0	-1.0	-0.8	-1.4	-1.4	-1.3	-1.4	-0.8	-0.8	-0.8
2021	0/100	4.2	50.0	65	65	60	60	68	70	64	67	69
2022	0/100	4.8	25.0	42	40	39	36	42	43	39	42	45
2073	0/100	3.0	150.0	28	28	28	28	28	27	27	27	27
2074	0/100	3.0	180.0	40	40	40	42	38	38	38	38	38
2075	0/100	3.0	180.0	45	47	45	41	47	45	45	44	45
2076	0/100	3.0	144.0	32	34	33	31	33	32	32	32	33
2077	0/100	3.0	144.0	18	21	14	10	24	18	16	18	18
2024	0/100	4.2	93.6	31	30	30	10*	10*	10*	10*	10*	10*
2025	0/100	4.2	300.0	10	8	6	20*	18.74*	17.87	17.3*	17.6*	17.6*
2026	-10/10	9.0	40.0	-3.0	-3.0	-4.0	-3.9	-4.8	-4.8	-4.0	-4.4	-4.5
2102	0/100	4.2	100.0	57	59	54	60	60	55	52	53	52
2020	0/100	4.2	300.0	54	60	56	54	66	60	62	60	63
2036	-10/10	9.0	100.0	-1.8	-1.9	-2.0	-1.8	-2.0	-2.0	-1.9	-2.0	-2.0
2028	0/100	4.8	50.0	89	88	83	92	85	83	77	81	80
2080	-2/2	9.0	40.0	73	75	72	73	70	72	70	73	74

Location**	Pressure, In. W.C.***								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	78.28	67.52	75.84	70.97	53.42	63.83	54.92	63.74	57.44
3	205.95	195.75	197.29	196.36	177.41	176.31	161.23	169.82	160.25
4	280.56	270.04	267.55	267.23	248.81	243.72	226.72	235.28	224.34
5	266.14	287.00	284.40	277.87	299.67	290.93	285.52	288.03	292.05
6	260.79	282.90	277.27	270.80	293.00	283.83	281.50	284.02	288.04
7	217.93	238.33	235.13	228.97	245.31	235.56	236.73	236.99	239.18
8	177.72	196.13	192.65	186.08	203.18	194.38	195.14	195.38	197.51
9	-18.75	-11.40	-3.49	-24.90	-19.16	-17.20	-17.23	-3.62	-17.07
10	-45.32	-42.91	-24.26	-41.80	-58.49	-46.35	-43.39	-31.28	-46.42
11	6.15	6.01	8.27	7.23	8.68	8.94	7.42	8.67	8.31
12	128.49	122.18	125.95	127.56	108.95	115.14	103.75	113.59	106.37
13	247.38	264.45	257.37	254.34	268.49	258.94	254.96	258.89	260.86
14	239.02	255.19	247.56	245.42	258.75	249.09	245.50	248.93	250.89
15	187.23	206.05	201.29	195.03	211.06	202.98	202.85	204.30	206.81

*Common tap plugged; values calculated by difference (2024 set at zero reading, 2025 = 2030 - 2026).
**Refer to Figure 2.
***Static pressure at Location 1 is 150 psig.
Pressures given are differential pressures from Location 1.

Table 39-11. PRESSURE BALANCE DATA (Sheet 2 of 2)

		Temperature, °F
Gasifier		
Coal Feed	TE-2215/2216	280[1] - 360[2]
Boot Flow	TE-2040	1430
Side Flow	TE-2057	1500
Regenerator		
Air Inlet	TE-2026	840
Acceptor Lift Gas	TE-2013	1350
Char Lift Gas	TE-2041	780[1] - 770[2]

[1] First balance period (1200 9/29/76 - 0500 9/30/76).
[2] Second balance period (1200 10/2/76 - 0900 10/3/76).

Table 39-12. AVERAGE PREHEAT TEMPERATURES

Date	9/28/76	← 9/29/76 →				9/30/76
Time	0700	2100	0500	1100	2100	0500
Carbonate Tower						
Feed Gas, SCFH (Wet)	26,949	34,117	35,720	35,537	37,282	37,523
Feed Gas, SCFH (Dry)	26,630	33,702	35,309	35,000	36,813	37,063
Temperature, °F	129	121	118	128	123	123
Pressure, PSIG	130	130	130	130	133	137
Compositions, Mol %						
H_2 (Dry)	59.40	59.76	59.66	60.06	61.16	60.56
N_2 (Dry)	3.80	3.20	2.80	3.80	4.10	5.11
CO (Dry)	14.70	15.12	14.81	14.31	14.11	13.61
CH_4 (Dry)	11.90	12.11	12.61	12.11	13.21	13.21
CO_2 (Dry)	10.20	9.81	10.11	9.71	7.41	7.51
H_2O	1.18	1.22	1.15	1.51	1.26	1.22
$\tilde{MW}$ (Wet)	12.84	12.66	12.67	12.59	11.80	11.96
HHV, Btu/SCF (Dry)	360	364	368	363	377	373
Methanation Feed						
Feed Gas, SCFH (Wet)	14,720	19,352	24,252	24,658	24,810	24,241
Feed Gas, SCFH (Dry)	13,380	17,555	22,745	23,126	22,736	22,255
Temperature, °F (1)	723	655	650	650	640	631
Temperature, °F (2)	532	564	565	563	564	-
Temperature, °F (3)	576	558	562	566	561	-
Pressure, PSIG	115	115	115	115	115	115
Compositions, Mol %						
H_2 (Dry)	62.66	62.16	63.20	63.90	64.20	62.70
N_2 (Dry)	3.40	3.50	3.70	3.90	4.50	5.50
CO (Dry)	15.32	15.12	16.20	15.70	15.00	13.80
CH_4 (Dry)	12.71	12.81	12.90	13.40	13.80	13.80
CO_2 (Dry)	5.91	6.41	4.00	3.10	2.50	4.20
H_2O	9.10	9.29	6.21	6.21	8.36	8.19
$\tilde{MW}$ (Wet)	11.77	11.96	11.13	10.77	10.73	11.33
HHV, Btu/SCF (Dry)	381	379	387	393	396	387
Methanation Recycle						
Feed Gas, SCFH (Wet)	26,288	37,633	38,012	37,257	36,380	34,028
Feed Gas, SCFH (Dry)	26,052	37,525	37,847	37,004	36,206	33,860
Temperature, °F	133	151	149	155	152	154
Pressure, PSIG	108	140	135	135	135	135
Compositions, Mol %						
H_2 (Dry)	1.70	1.20	1.40	2.10	8.30	6.30
N_2 (Dry)	8.50	7.91	10.70	10.30	9.40	12.40
CO (Dry)	0.00	0.00	0.00	0.00	0.00	0.00
CH_4 (Dry)	77.70	84.08	85.30	82.50	82.30	80.40
CO_2 (Dry)	12.10	6.81	2.60	5.10	0.00	0.90
H_2O	0.89	0.42	0.43	0.68	0.48	0.49
$\tilde{MW}$ (Wet)	20.19	18.72	17.85	18.40	16.01	16.90
HHV, Btu/SCFH (Dry)	790	853	866	840	858	832
Adiabatic Reactor						
Feed Gas, SCFH (Wet)	5,896	7,802	9,314	8,790	9.653	9,799
Feed Gas, SCFH (Dry)	5,843	7.769	9,274	8,731	9,607	9,750
Temperature, °F	100	76	77	91	80	81
Pressure, PSIG	93	93	93	93	93	93
Compositions, Mol %						
H_2 (Dry)	1.70	1.20	1.40	2.10	8.30	6.30
N_2 (Dry)	8.50	7.91	10.70	10.30	9.40	12.40
CO (Dry)	0.00	0.00	0.00	0.00	0.00	0.00
CH_4 (Dry)	77.70	84.08	85.30	82.50	82.30	80.40
CO_2 (Dry)	12.10	6.81	2.60	5.10	0.00	0.90
H_2O	0.89	0.42	0.43	0.68	0.48	0.49
$\tilde{MW}$ (Wet)	20.19	18.72	17.85	18.40	16.01	16.90
HHV, Btu/SCFH (Dry)	790	853	866	840	858	832
Water Collected, lb/hr	NA	312	311	364	308	323
Dowtherm Circulation Rate, lb/hr	38,300	38,900	38,900	30,200	17,500	17,500
Temperature to DC-402, °F	600	557	560	555	540	543
Temperature from DC-402, °F	619	588	587	583	577	580
Dowtherm Condensed, lb/hr	2,040	3,880	2,510	2,480	2,490	2,500
Temperature of Condensed Dowtherm, °F	485	325	365	350	345	

(1) Temperature at flow measuring orifice.
(2) Temperature of fresh feed plus recycle at reactor inlet.
(3) Temperature of reactor effluent.

Table 39-13. METHANATION UNIT OPERATING CONDITIONS

			Distance from Bottom of Catalyst-Filled Tube, ft.-in.														
Date	Time	TE No.	0	1-0	1-6	2-6	3-6	4-6	5-0	5-3	5-5	5-6	5-7	5-8	5-9	5-10	5-11	6-0
9/28/76	2114	3	565			582		613				687				775	797	815
9/29/76	0500	3	565		570		580	610				687						812
9/29/76	1115	3					584	615	648	665	680	685	708		752			805
9/29/76	1245	3	572		578		590	615				685	715		750			810
9/29/76	2020	3		570		572		602	640	664	678	682	710		760			825
9/30/76	0030	3			572		582	616	642	660	677	680	712		752			818
9/30/76	0400	3					585	610				708	718	735	765	782	805	818

			Distance from Bottom of Catalyst-Filled Tube, ft.-in.														
Date	Time	TE No.	6-1	6-2	6-3	6-4	6-5	6-6	6-7	6-8	6-9	6-10	6-11	7-0	7-6	8-6	9-6	10-6
9/28/76	2114	3	830	845	832	795	751	722							575			
9/29/76	0500	3	830	840	830	790	750	705	559	605	575	570	570	570				
9/29/76	1115	3						672							569	567	565	566
9/29/76	1245	3	824	820	800			675							570			
9/29/76	2020	3	830	822				667							562			
9/30/76	0030	3		825														
9/30/76	0400	3	823	810	797	745	705	630/672										

Date	Time	TE No.	Dowtherm Circulation Rate, lb/hr	Dowtherm Temperature Reactor In-Out, °F
9/28/76	2114	3	38,900	557-588
9/29/76	0500	3	38,900	560-587
9/29/76	1115	3	30,200	555-583
9/29/76	1245	3	30,200	555-581
9/29/76	2020	3	17,500	540-578
9/30/76	0030	3	17,500	545-578
9/39/76	0400	3	17,500	543-580

Table 39-14. METHANATOR TEMPERATURE PROFILES

Sample Description	Conglomerate Material	Top of Vessel	Fine Yellow Material	Hard Gray Surface Material	Overhead Exit Nozzle
Calcine Change, Wt %	-4.9	5.5	-.3	-2.8	+4.0
Elemental Analysis, Wt %					
SiO_2	25.72	18.01	43.06	27.76	15.89
SO_3	14.10	12.40	1.18	14.88	14.02
Na_2O	0.46	0.45	11.01	0.57	1.84
CaO	52.45	60.99	30.20	47.20	55.50
MgO	1.88	2.45	2.09	2.24	4.19
K_2O	0.09	0.06	0.49	0.11	0.46
Al_2O_3	3.24	3.03	6.24	3.95	4.17
Fe_2O_3	1.80	2.78	4.56	3.02	3.86
P_2O_5	0.04	0.03	0.02	0.02	0.02
TiO_2	0.11	0.16	0.39	0.17	0.23

Table 39-15. REGENERATOR DEPOSIT ANALYSIS

RUN 40

RUN 40A OCTOBER 22 TO OCTOBER 29, 1976

RUN 40B NOVEMBER 7 TO NOVEMBER 21, 1976

CO_2 ACCEPTOR PROCESS GASIFICATION

PILOT PLANT

RAPID CITY, SOUTH DAKOTA

1 SUMMARY

Run 40, which was conducted in two parts, was the first run in which Texas lignite was used as a gasifier feedstock. The first part of the run (40A) which lasted 66 hours was terminated due to a 12 minute electrical power failure. The run lasted long enough to reveal a substantial buildup of intermediate fines in the gasifier char bed. The accumulation of junk caused a high char bed density and severely inhibited the showering of acceptor through the bed. The source of the junk was clay, sandstone and petrified wood included in the coal seam.

In the second part of the run (40B), two steady-state balance periods were obtained lasting 17.5 and 12 hours respectively. As in Run 40A a low acceptor circulation rate made it necessary to inject 11,000 to 12,000 SCFH of air into the gasifier char bed to maintain process temperatures during the balance periods. Following these periods the circulation rate was increased, and the air injection rate decreased to about 5,000 SCFH. Efforts were being made to stabilize the char bed density at these new conditions when the dip tube from the gasifier internal cyclone fell into the top section of the gasifier boot. This allowed gas to bypass the char bed making it impossible to maintain a stable interface.

Velva lignite was used as auxiliary fuel to the regenerator for the first time during Run 40B. No ill effects were noticed. The use of dried coal as an auxiliary fuel may be important in a commercial plant as a means of disposal of some of the coal fines generated in the grinding operations.

2 TEST DATA

Run 40A and 40B data are presented graphically and/or tabularly at the end of this report. These figures and tables include:

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Table 40-22. Balance Period Average Preheats for Run 40B 234

3 SIGNIFICANT EVENTS AND OBSERVATIONS

3.1 TABULAR HISTORY OF RUNS 40A AND 40B

3.1.1 Objectives

Run 40A

(1) Achieve integrated, steady-state plant operation with Texas lignite as the feedstock, followed by a voluntary and planned shutdown.

(2) Methanation of the synthesis gas from the gasifier.

Run 40B

(1) Achieve an integrated plant operation with a steady-state balance period with approximately 12,000 SCFH of air injected into the gasifier char bed.

(2) Test the use of Velva lignite as the auxiliary fuel feed to the regenerator.

3.1.2 Accomplishments

Run 40A

Operated the plant in an integrated manner for 55 hours with Texas lignite as the gasifier feedstock.

Run 40B

(1) Operated the plant in an integrated manner for 204 hours with Texas lignite as the gasifier feedstock.

(2) Obtained two steady-state balance periods with 11,000 to 12,000 SCFH of air injected to the gasifier char bed. The balance periods lasted 17.5 and 12 hours respectively.

(3) Fed Velva lignite as the auxiliary fuel to the regenerator for the entire run without any problems.

3.1.3 Termination Causes

Run 40A

A twelve minute power failure caused the gasifier and regenerator beds to defluidize. It was not possible to lift the regenerator bed back up after power was regained due to a plugged lift line. The plant is designed to tolerate power failures lasting only two seconds or less.

Run 40B

The run ended when the dip tube from the gasifier internal cyclone broke loose. The dip tube fell into the top section of the boot and rested on the side flow distributor ring. This allowed gas to bypass the gasifier char bed and made it impossible to maintain a stable char-acceptor interface.

3.1.4 Mechanical Problems

Run 40A

(1) There was considerable difficulty in grinding the Texas lignite. Frequently the lignite would stick to the Redler conveyor and cause it to plug. The sticking was due to a combination of wet lignite and the production of too many fines in the hammer mill.

(2) During the startup a leak was repaired on the gasifier overhead line cooling water jacket.

Run 40B

(1) Problems with the main air compressor twice delayed the startup of the run. First, the plant was put on hold for four hours to replace the air compressor rings. Two days later the plant was placed on hold for two hours while the exciter brushes were replaced. After each hold period about five hours was required to bring the plant back to normal operating conditions.

(2) Throughout the run pressure taps, sensing lines and transmitter froze up due to unseasonably cold weather. Several severe upsets were caused by the instrument freeze ups.

(3) The grinding area was plagued with problems caused by the presence of a large amount of scrap metal in with the Texas lignite feedstock. The hammer mill and roller mill had to be opened and cleaned many times.

(4) After shutting down, a crack was found in the liner pipe of the gasifier overhead line. The crack, which was about one inch long, was located at the end section of the line near the exit nozzle in the gasifier top head. The liner pipe was replaced back to the first 90 degree elbow.

(5) During the shutdown after Run 40B, a broken pressure probe was discovered in the gasifier boot. The probe was broken inside the refractory lining of the gasifier. The break probably caused the unstable operation of the char-acceptor interface controlling instruments (dPR-2083 and dPR-2002) noticed during the run.

(6) The acceptor lift gas heater, B-205, continued to deteriorate. After Run 40B three-quarters of a turn of one pass was replaced. The tubes are under constant attack by sulfur which slips through the SO_2 scrubbing tower.

3.1.5 Process Problems

Runs 40A and 40B

(1) The showering of acceptor through the gasifier char bed was greatly hindered by an accumulation of intermediate fines. At the end of Run 40B, the char bed sample indicated that over 20 percent of the bed was junk. This is twice the normal amount.

(2) The problem was compounded by the fact that the Texas lignite char appeared to have a significantly higher particle density than most other coals processed previously. When the feed was switched from Husky char to Texas lignite in Run 40A, the bed density dropped only to 42 LB/FT^3. With Velva and Glenharold lignites, the density initially decreases to between 30 and 35 LB/FT^3. Consequently, with the Texas lignite feedstock, densities of over 50 LB/FT^3 were encountered at even lower than normal circulation rates.

(3) As in the runs with subbituminous coal, the acceptor particle density dropped to a low value (108 LB/FT^3). The low particle density hindered acceptor showering and made it much more difficult to maintain a stable char-acceptor interface than in the runs with Velva and Glenharold lignites in which the particle density was about 120 LB/FT^3.

3.2 CHRONOLOGY OF OPERATIONS

Run 40A

Date	Time	Hours Run	Description
10/22	1630		Pressured up the system.
"	1825		Depressured the system for maintenance.

Date	Time	Hours Run	Description
10/22	2000		Pressured up the system.
"	2200		Started the static pressure test.
"	2225		Started grinding char.
"	2300		Finished the static pressure test.
"	2345		Sheared a pin on the Redler conveyor.
10/23	0220		Repaired the Redler conveyor and resumed grinding.
"	0450		Started the process recycle gas compressors.
"	0745		Finished grinding char.
"	0810		Depressured the system due to leaks.
"	1150		Pressured up the system.
"	1330		Started the static pressure test.
"	1400		Finished the static pressure test.
"	1610		Started the recycle gas compressors.
"	1615		Lit the process heaters.
"	2000		System at 250°F, started the refractory cure holding period.
"	2200		Finished the refractory curing period and raised temperatures.
10/24	0930		System at 700°F, started the second refractory cure holding period.
"	1130		Finished the refractory curing period, raising heater temperatures. Started the heater differential pressure tests.
"	1340		Finished the heater differential pressure tests.
"	1830		Started feeding dead-burned dolomite to the gasifier via F-204A, fresh lignite feed lockhopper.
"	2045		Transferred a batch of dolomite from the gasifier to the regenerator.
"	2140		Started feeding dead-burned dolomite to the regenerator via F-206, fresh limestone feed lockhopper.
10/25	0615		Initiated solids circulation.
"	0840		Started solids circulation tests.
"	1250		Finished the circulation tests and started the lift line tests.
"	1320		Finished the lift line tests, started steam flow to the gasifier side flow.
"	1350		Started grinding Texas lignite.
"	1407		Started feeding char to the gasifier.
"	1516		Found a leak in the gasifier overhead cooling water jacket.
"	1900		Repaired the jacket leak.
"	2000		Initiated air flow to the gasifier side.

Date	Time	Hours Run	Description
10/25	2300		Started char transfer.
"	2400		NOTE: Trouble grinding Texas lignite because it was very wet.
10/26	0400	0	Regenerator at 1800°F.
"	0420		Lost char transfer.
"	0545		Regained char transfer.
"	0810		Initiated steam flow to the boot.
"	1355		Started feeding Texas lignite to the gasifier.
"	1640		Removed the recycle gas from the regenerator side flow.
"	2000		Started feeding fresh limestone to the system.
"	2400		NOTE: Experienced problems all day with grinding lignite.
10/27	0020		Began the air removal from the gasifier.
"	2207	42.1	Started the extra N_2 purge to the calcined acceptor standleg in order to decrease the gasifier bed density.
10/28	0100-2122		Worked on reducing the gasifier bed density.
"	2122	65.4	Experienced a power failure.
"	2134		Regained power, however, unable to regain a fluidized regenerator bed due to a plugged lift line, CD-208.
"	2225		Initiated shutdown procedures.
10/29	0510		Depressured the unit to dump the regenerator.
Run 40B			
11/7	2338		Pressured up the system.
11/8	0140		Started the static pressure test. NOTE: Maintenance had to tighten several leaks.
"	0530		Finished the static pressure test.
"	0825		Lit the process heaters except for B-203 and B-204.
"	0955		Electricians repaired B-204 heater and it was lit.
"	1150		Electricians repaired B-203 heater and it was lit.
"	1310		System at 250°F, started the first refractory cure holding period.
"	1342		Experienced a power dip.
"	2110		Finished the refractory cure holding period, raised system temperatures.
11/9	0715		System at 700°F, started the second refractory cure holding period.

Date	Time	Hours Run	Description
11/9	1115		Finished the refractory cure holding period, raised system pressure.
"	1350		Started Case 1 of the heater differential pressure tests.
"	1645		Started Case 2 of the heater differential pressure tests.
"	1700		Finished the heater differential pressure tests.
"	1930		Started grinding Texas lignite for the preheater.
"	2135		Started feeding dead-burned dolomite to the gasifier via F-204A, fresh lignite feed lockhopper.
11/10	0115		Started feeding dead-burned dolomite to the regenerator via F-206, fresh acceptor feed lockhopper.
"	0125		Stopped grinding lignite to work on the roller mill.
"	1110		Initiated solids circulation.
"	1220		Started the acceptor circulation tests.
"	1345		Finished the acceptor circulation tests, started the lift line flow tests.
"	1600		Finished the lift line flow tests.
"	1915		Started grinding Texas lignite for the preheater.
"	2025		Initiated steam flow to the gasifier side.
"	2143		Started feeding char to the gasifier via F-204A.
11/11	0220		Initiated air flow to the gasifier side.
"	0315		Switched grinding from Texas lignite to Velva lignite. All Velva lignite is going to tote bins.
"	1330		Established char transfer to the regenerator.
"	1540		Stopped grinding Velva lignite, started grinding Texas lignite.
"	1825		Started feeding auxiliary lignite to the regenerator. NOTE: In this run, Velva lignite instead of Husky char was used for the auxiliary fuel.
"	1915		Char transfer lost due to depressuring F-215, char removal lockhopper.
"	1938		Regained char transfer.
"	2000	0	Regenerator at 1800°F.
"	2130		Fed Texas lignite to the system.
"	2140		Fed fresh 6 X 8 limestone to the system.

Date	Time	Hours Run	Description
11/12	1100		Switched grinding from Texas to Velva lignite.
"	1110	15.6	Brought the unit into a holding period. Repairs needed on J-202, main air compressor. Removed air and all solids feed.
"	1240		Switched grinding from Velva to Texas lignite.
"	1500		J-202 repaired, brought the plant back to normal operating conditions.
"	1507		Stopped grinding lignite for maintenance work.
"	1530		Started char transfer.
"	1620		Started auxiliary fuel to the regenerator.
"	1640		Initiated steam to the gasifier boot.
"	1916	0	Regenerator at 1800°F.
"	2038		Started feeding Texas lignite to the gasifier.
"	2400	4.7	Adjusted steam, recycle gas and air flow to the gasifier to meet desired operating conditions.
11/13	0230		Started grinding Texas lignite to the pre-heater.
"	1230		Switched grinding from Texas to Velva lignite.
"	1800		Stopped grinding for maintenance.
"	1940		Started grinding Texas lignite for the pre-heater.
"	2400	28.7	Attempted to lower char bed density all day.
11/14	0830		Blew the gasifier interface due to boot instrument problems. Stopped all circulation and solids feed.
"	0915		Resumed stone circulation.
"	1030		Resumed Texas lignite feed.
"	1035		Resumed limestone makeup.
"	1335		Resumed char transfer.
"	2400	48.7	Attempted to lower the gasifier bed density all day.
11/15	0120	50	Lost J-202, main air compressor, placed plant on hold.
"	0230		Stopped grinding lignite for maintenance work.
"	0310		J-202 repaired, started bringing plant back to normal operating conditions.
"	0345		Resumed feeding Texas lignite.
"	0420		Resumed char transfer.
"	0458		Resumed auxiliary lignite feed.
"	0715		Resumed feeding fresh limestone.
"	0845		Started grinding Texas lignite for the preheater.
"	2400	72.7	Continued efforts to lower the gasifier bed density.

Date	Time	Hours Run	Description
11/16	2400	96.7	Continued efforts to lower the gasifier bed density.
11/17	0940		Stopped grinding lignite for maintenance work.
"	0955		Started grinding Velva lignite for the tote bins.
"	1957		Lost fresh limestone feed due to trouble filling F-206.
"	2005		Resumed fresh limestone feed.
"	2045		Switched grinding from Velva to Texas lignite.
"	2400	120.7	Continued to work on lowering the gasifier bed density.
11/18	0655		Experienced a small power dip.
"	2400	144.7	Continued working on the high gasifier bed density and decreasing air to the gasifier.
11/19	1025		Stopped grinding Texas lignite to allow maintenance work.
"	1250		Started grinding Velva lignite to tote bins.
"	1840		Stopped grinding lignite to allow maintenance work.
"	2040		Started grinding Texas lignite for the preheater.
"	2400	168.7	Continued working on the high gasifier bed density, while increasing acceptor circulation and removing air from the gasifier.
11/20	0445		Stopped grinding lignite for maintenance work.
"	0455		Stopped overhead circulation for a short period in an attempt to lower the gasifier bed density.
"	0810		Started grinding Texas lignite for the preheater.
"	0930	178.2	Experienced an upset in the gasifier boot, switched LCV-2003 to manual control.
"	0940		Stopped grinding lignite for the preheater.
"	0955		Stopped acceptor circulation and fresh lignite feed.
"	1015		Blew the gasifier interface.
"	1017		Shut off fresh limestone feed to the re-generator.
"	1121		Blew the gasifier interface again.
"	1155		Started shutdown procedures.
11/21	0620		System depressured.

4 RESULTS AND DISCUSSION

4.1 BACKGROUND

Prior to these two runs, Texas lignite and never been used as a gasifier feedstock. Preliminary analyses of the lignite indicated that it was low in sodium (0.6 weight percent Na_2O in the sulfur-free ash) so the "standard" startup procedure was used. These analysis also revealed the presence of large amounts of ash in the lignite (11.9 percent on a sulfur-free basis) and that the ash contained substantial amounts of silica (59.2 percent on a sulfur-free basis).

The only previous feedstock with a similar analyses was Husky char. The last time that Husky char had been fed to the gasifier for an extended period was in Run 35. In this run intermediate fines accumulated in the gasifier char bed and inhibited acceptor showering, making it very difficult to remove all the air from the gasifier. It was hoped that the purge installed on the upper acceptor standleg during Run 39 would strip the fines from the standleg and trap them in the regenerator. As in Run 39 the fresh acceptor makeup rate would be increased to 900 LB/HR in order to increase the acceptor withdrawal rate from the regenerator and remove more fines.

4.2 ACCOMPLISHMENTS

4.2.1 Major Operational Achievements

The pilot plant operations for Run 40A and 40B are summarized below:

SUMMARY OF PLANT OPERATIONS

HOURS OF OPERATION

Run	Acceptor Circulation	Process Conditions	Texas Lignite Feed	Fresh Acceptor Makeup
40A	85	66	55	49
40B	238	194	192	190

In addition to the above accomplishments, Run 40B provided two other successes. In that run two balance periods of 17.5 and 12 hours respectively were obtained in which the pilot plant was at steady-state conditions. Run 40B also successfully demonstrated that dried lignite could be reliably burned in the regenerator. Throughout the run Velva lignite was used as auxiliary fuel and no ill effects were observed.

4.2.2 Plant Data

The pertinent data for both runs is presented in Tables 40-1 through 40-22. Operating conditions are shown in Tables 40-1 through 40-4. Feedstock composite analyses are presented in Tables 40-5 and 40-6. Effluent and circulated process stream solids analyses are shown in Tables 40-7 through 40-20. Pressure balance data and calculated pressure balances are given in Table 40-21 for Run 40B. Locations and elevations of the pressure points are shown in Figure 40-1. The raw pressure balance data was corrected as described in the Run 17 report and forced to converge as explained in the Run 28 report. Preheats of the feed streams are given in Table 40-22 for the two balance periods in Run 40B.

4.2.3 Activity

The acceptor activity is defined as the moles of active calcium oxide per mole of calcium in the stone. The activity, which serves as a measure of the acceptor's ability to react with CO_2, is plotted as a function of time in Figure 40-2. Run 40B was of sufficient length to allow the complete change out of dead-burned dolomite. The activity for this run was in the range of .16 to .18 which is higher than the .10 to .13 range normally encountered. The reduced circulation rate during this run increased the acceptor residence time in the gasifier and thus the activity. In addition, a higher fresh acceptor makeup rate of 900 LB/HR was used during this run. The higher rate decreased the average age of the acceptor particles and thus tended to increase the measured activity.

4.3 PROBLEMS

4.3.1 Deposits

After Run 40B deposits were found in both the gasifier and the regenerator. The gasifier deposit was located in the lower portion of the boot. This deposit was made of active acceptor and dead-burned dolomite. As in previous runs, the deposit formed a natural outlet to the acceptor standleg. A portion of the deposit was found above the bottom head flange. This deposit may have been the cause of the erratic boot dP's noted during the run. Although the dP's spiked and behaved abnormally, there was no great problem in controlling the char-acceptor interface.

In general, the gasifier boot deposit was typical of deposits found after previous runs. These deposits are thought to be due to the formation of dead areas in the boot section which are caused by poor gas distribution. An attempt will be made in the next run to correct this situation with the installation of a differently designed boot gas distributor.

The regenerator was found to contain a hard acceptor deposit on top of the gas distribution ring. The deposit was about four-inches thick at the ring and gradually tapered down to nothing about two feet above the ring. Some hard chunks of acceptor were found laying in the coned bottom of the regenerator near the lift line inlet. None of the deposits found after the shutdown appeared to have had a serious effect on operations. All deposits formed in dead, nonfluidized zones in the reactors.

4.3.2 Intermediate Fines and High Bed Density

The major problems faced during these runs was a gasifier char bed density between 44 and 48 LB/FT^3. The high bed density limited the acceptor circulation rate to such an extent that 11,000 to 12,000 SCFH of air had to be injected into the gasifier to maintain the desired temperature. Three factors apparently combined to cause the high density. They are: (1) an accumulation of intermediate fines in the bed; (2) a high char particle density; and (3) a low limestone particle density.

The percentage of intermediate fines in the gasifier char bed is plotted in Figure 40-3. From this graph it is apparent that the fines rapidly accumulated in the gasifier until over twenty percent of the bed consisted of -20 mesh acceptor material. The source of the fines was the high percentage of ash (12 to 15 percent including SO_3) in the Texas lignite as compared to a typical 6 to 8 percent in other coals. This ash was very rich in silica which has caused problems in previous runs. The silica forms particles which are too big and dense to be blown overhead from either the regenerator or the gasifier and are too small to shower through the boot with the acceptor. With low silica coals such as Velva lignite, fines normally accumulate until they make up only ten percent of the bed.

After Run 40A indicated problems with intermediate fines an attempt was made to screen out the -1/4 inch portion of the coal stockpile which, based on a few samples, was exceptionally rich in ash. The screening helped reduce, but did not eliminate, the accumulation of fines Two other methods of controlling the accumulation of intermediate fines were tried without success. The fresh acceptor makeup rate was increased to 900 LB/HR to force the removal of a larger share of the intermediate fines from the regenerator. A nitrogen purge was placed in the calcined acceptor standleg to try and strip the fines from the acceptor and concentrate them in the regenerator. There they would be removed with spent acceptor which is continually purged from the system.

Though these measures appeared to help control the intermediate fines in Run 39, they did not succeed in this run. Perhaps, due to differences in the coal ash and rates of acceptor attrition, the fines

in Run 40 are significantly different from those in Run 39. Differences in average density or diameter of the two types of fines might have been enough to prevent stripping of the Run 40 fines from the acceptor in the standleg.

The second factor responsible for the high bed density was the char particle density. Though it has not yet been proven by laboratory analysis that the char particle density was higher than usual, there exists strong, indirect evidence from the plant operation to this effect. In all previous runs using Velva and Glenharold lignites and Rosebud and Wyodak subbituminous coals, the gasifier char bed density had dropped after the Husky char used for startup was replaced with the desired feed. Normally, the drop in density was from the range of 46 to 50 LB/FT^3 while using Husky char to a range of 32 to 38 LB/FT^3 while feeding the other coals. However, during Run 40A the bed density never decreased below 41 LB/FT^3, and in Run 40B the density dropped below 40 LB/FT^3 only when the acceptor circulation was cut to very low levels, approximately 4,000 LB/HR. Tedious laboratory work is required to separate the char particles from the acceptor in the gasifier bed samples before the char particle density can be measured.

The final factor causing a high bed density was an extremely low acceptor particle density. During the final part of the run, the particle density averaged 110 LB/FT^3 and the acceptor bed density in the boot was about 51 LB/FT^3. Low acceptor densities have been encountered in previous runs using subbituminous coals. In those runs as in Run 40 the low density was accompanied by the formation of a thin acceptor shell. Normally, the acceptor forms a thick shell due to interaction with the coal ash.

One might wonder how it was possible to maintain the char-acceptor interface necessary for process control when the acceptor bed density was down to 51 LB/FT^3 and the char bed density approached 48 LB/FT^3. In previous runs the plant had not been able to operate with these "degenerate" conditions. However, in this run about 37,000 SCFH of air and steam were injected into the side of the gasifier to maintain process temperatures. This flow when combined with the flow from the boot was enough to strip the char from the acceptor and prevent the transfer of char through the spent acceptor standleg. Thus, it was possible to keep the acceptor lift line and regenerator temperatures under control. The plant did not operate for an extended period at these conditions due to the internal cyclone failure. It is possible that continued operation at such a high char bed density might cause bridging in the bed and unstable acceptor transfer. On the other hand, the velocity in the transition section might be high enough to prevent this bridging from occurring. Further operation at these conditions is required for a complete explanation.

5 FUTURE PLANS

Two major mechanical modifications will be made to the plant prior to the next run. A ceramic-lined acceptor lift line and a new gasifier boot flow distributor will be installed. The lift line is intended primarily as a safety precaution so that air can be used as the acceptor lift gas. The line is designed to withstand transient temperatures of up to 3400^{o}F. However, air will not be used as the lift gas until the regenerator diameter is reduced from 33 to 24 inches.

The new boot distributor which uses a center withdrawal of acceptor through the distributor ring should eliminate the dead spots and deposits which have previously formed in the bottom of the boot. This could also improve the gas distribution pattern in the boot. The purpose of the next run will be to test the operation of the new distributor and the new lift line. Wyodak subbituminous coal will be used for both the gasifier feedstock and as the auxiliary fuel to the regenerator.

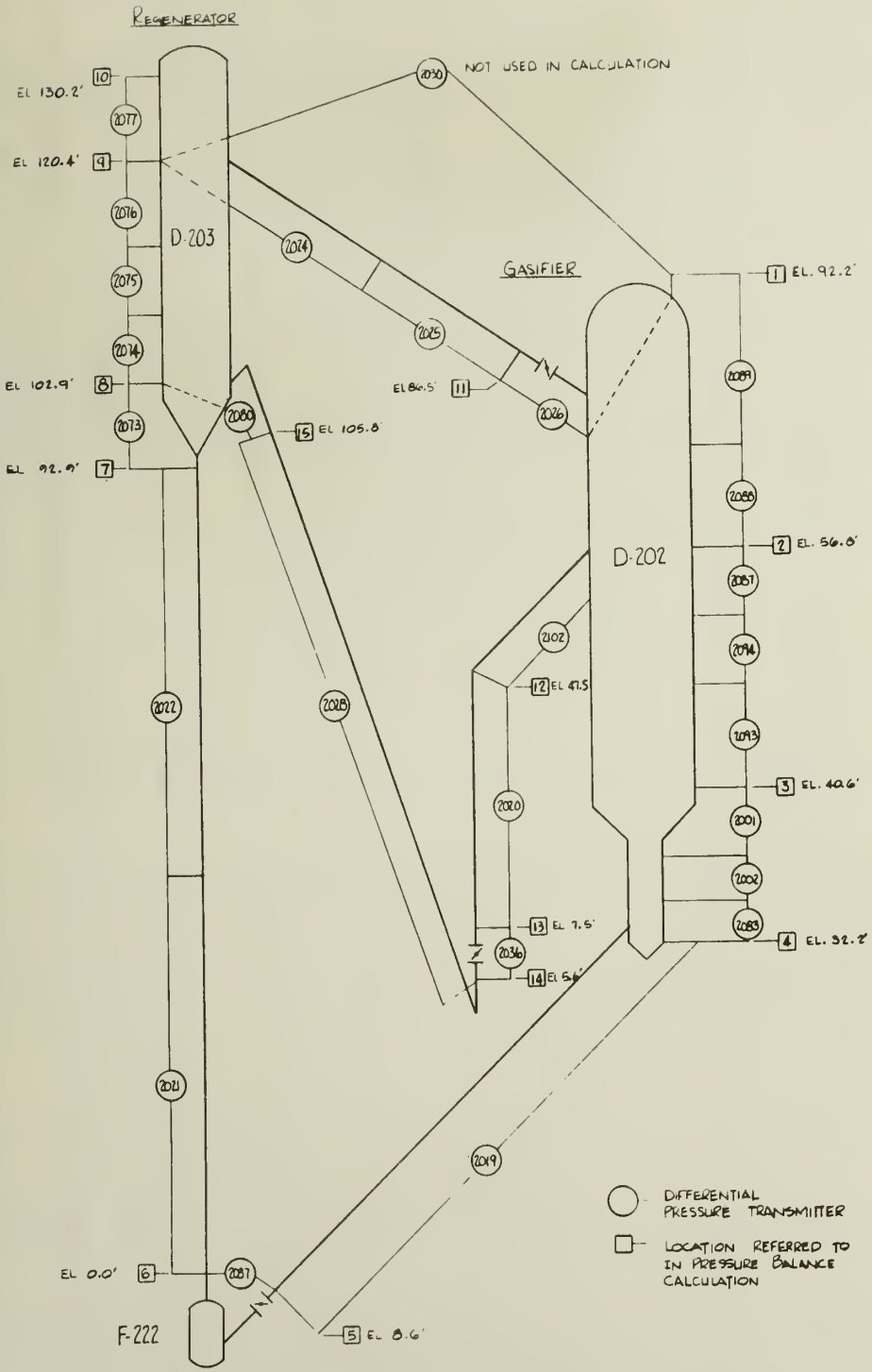

Figure 40-1. DIFFERENTIAL PRESSURE TRANSMITTER LOCATION FOR PRESSURE BALANCE CALCULATION

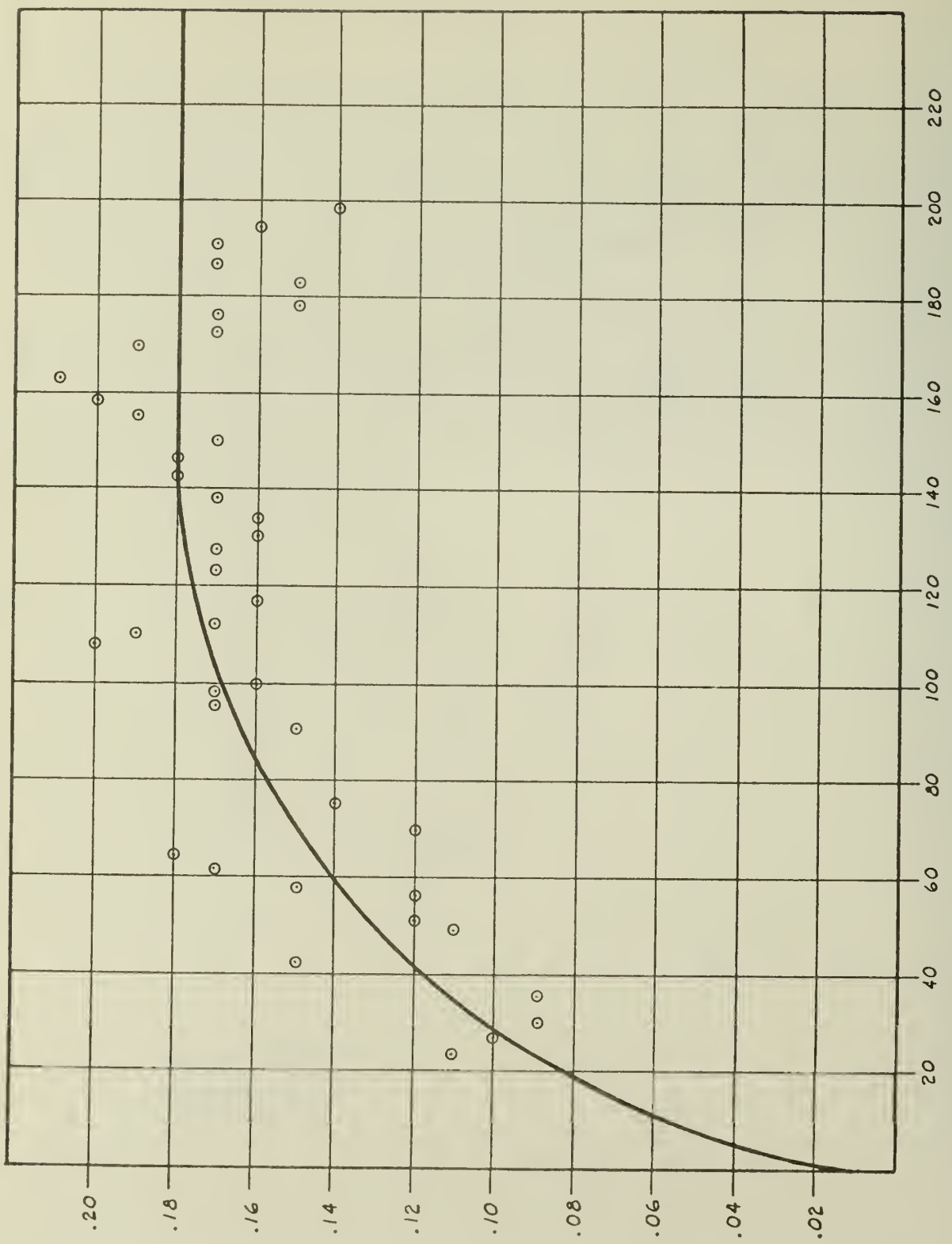

Figure 40-2. ACCEPTOR ACTIVITY FOR RUN 40B

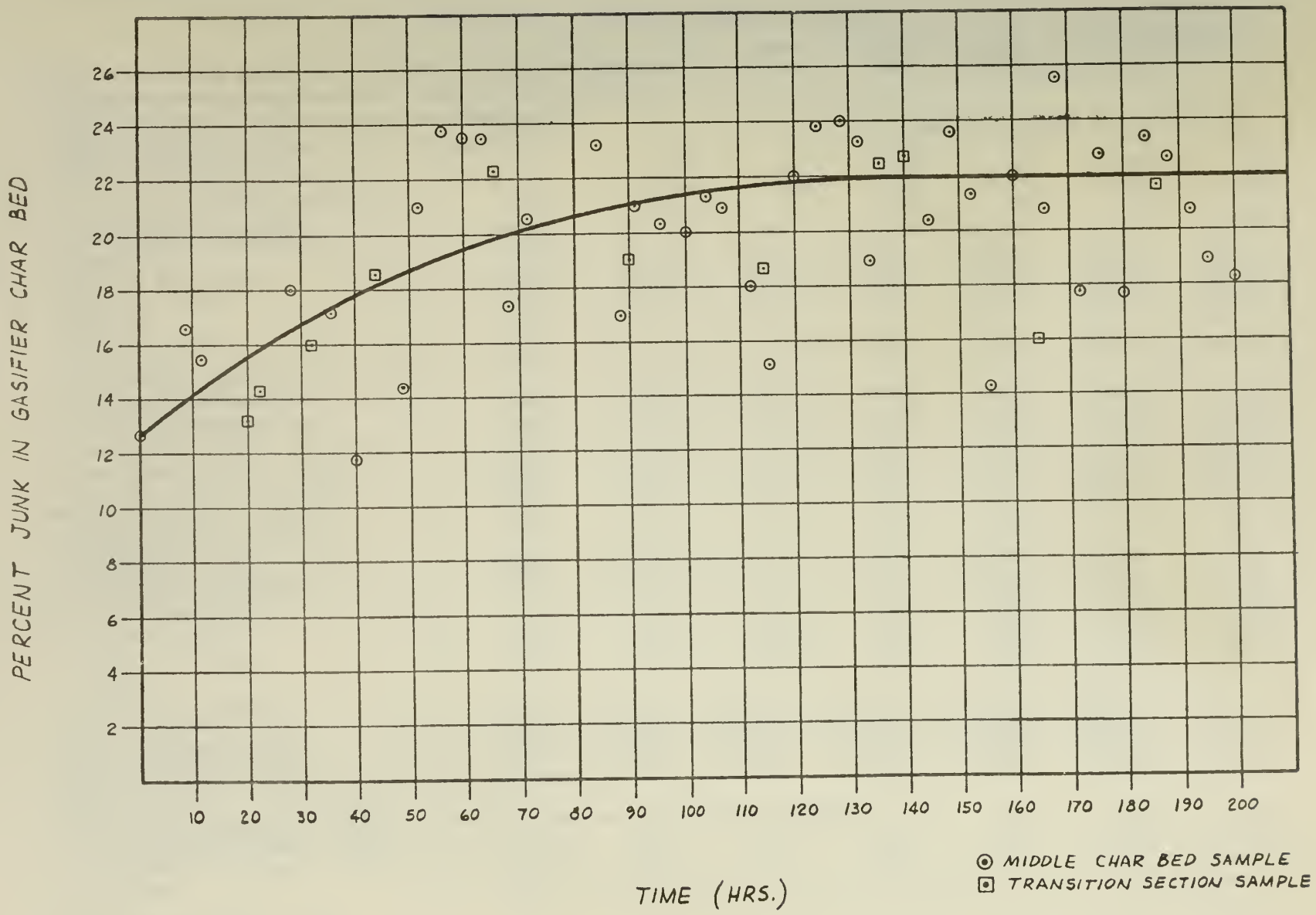

Figure 40-3. PERCENT JUNK IN THE GASIFIER CHAR BED FOR RUN 40B

Date	10/26/76		← 10/27/76 →			10/28/76	
Time	1500	2300	0700	1500	2300	0700	1500
Jacket Steam Make, lb/hr	0	0	0	0	0	0	0
Solids							
Feedstock	← Texas Lignite →						
Feed Rate, lb/hr[1]	1,880	2,250	2,250	2,250	2,250	2,250	2,710
Cyclone Solids Dump, lb/hr	165	385	175	189	226	199	398
Quench Tower Solids, lb/hr	67	73	71	70	92	65	79
Gas Flows[2]							
Boot (Recycle), SCFH	19,900	20,400	17,200	13,200	12,400	11,600	10,500
Boot (Steam), SCFH	18,900	18,800	22,300	25,800	25,200	27,700	26,800
Side (Steam), SCFH	30,100	30,100	27,900	26,900	26,900	26,700	26,300
Side (Air), SCFH	19,300	19,500	14,400	12,200	11,800	11,900	18,200
Purges							
Recycle, SCFH	2,290	2,010	2,080	2,290	2,370	2,490	2,410
Inert, SCFH	370	380	420	390	360	340	260
Nitrogen, SCFH	740	1,240	1,280	1,160	2,280	2,280	3,590
Total Flow In, SCFH	91,600	92,400	85,600	81,900	81,300	83,000	77,600
Vent Rate, SCFH	58,600	58,500	52,200	51,700	51,400	44,900	57,700
Bed Conditions							
Boot Velocity, ft/sec	2.01	1.97	2.05	2.14	2.08	2.11	2.01
Char Bed Velocity, ft/sec	0.93	0.93	0.86	0.84	0.83	0.83	0.75
Boot Density, lb/ft^3[3]	98.0	98.0	87.0	78.0	72.0	66.0	66.0
Char Bed Density, lb/ft^3[3]	46.0	43.0	41.0	44.0	46.0	44.0	48.0
Boot Temperature, °F	1459	1480	1497	1525	1541	1530	1524
Char Bed Temperature, °F	1476	1488	1489	1491	1501	1486	1476
Overhead Gas Compositions, Mol %							
CO	15.0	14.8	13.4	12.8	12.9	12.2	12.1
CO_2	17.0	15.7	14.6	13.7	14.0	14.6	14.2
N_2	29.0	28.0	24.6	21.8	20.6	22.0	27.6
H_2	32.0	33.9	38.2	41.6	42.2	41.4	36.6
CH_4	6.3	7.5	9.1	10.0	10.2	9.6	9.3
H_2O Mole Fraction[4]	25.8	23.2	25.8	26.9	27.7	29.6	29.8

(1)
(2) Determined by feeder rpm - 417*RPM
(3) Determined by orifice flow measurements
(4) Determined by differential pressure measurements
Calculations based on water-gas shift equilibriums

Table 40-1. GASIFIER DATA FOR RUN 40A

Date	10/26/76		10/27/76			10/28/76	
Time	1500	2300	0700	1500	2300	0700	1500
Jacket Steam Make, lb/hr	0	0	0	0	0	0	0
Solids	Dead-Burned Dolomite	6 X 8 Minnekahta Limestone					
Acceptor Feedstock	720	840	840	840	840	840	840
Acceptor Makeup, lb/hr[1]	2,310	968	791	425	417	313	657
Acceptor Withdrawal, lb/hr[2]	9,600	11,300	8,760	8,450	7,300	6,420	4,750
Acceptor Circulation, lb/hr[3]	163	125	135	150	299	368	297
Ash and Attrited Acceptor, lb/hr[2]	147	110	221	166	294	195	368
Auxiliary Fuel Char, lb/hr[1]							
Gas Flows[4]							
Acceptor Lift, SCFH	55,300	54,600	54,600	54,300	54,200	54,500	54,200
Char Lift, SCFH	9,970	10,000	10,000	9,970	9,970	10,000	9,930
Air Line							
Recycle, SCFH	25,100	0	0	0	0	0	0
Air, SCFH	66,200	54,100	65,900	66,000	69,000	65,400	72,000
Purges							
Recycle, SCFH	2,100	2,170	2,010	1,960	2,010	1,870	1,780
Inert, SCFH	1,310	1,310	1,310	1,030	1,080	1,030	360
Nitrogen, SCFH[5]	340	390	400	380	460	460	550
Total Flow In, SCFH	160,300	122,600	134,200	133,600	136,700	133,300	138,800
Vent Rate, SCFH	84,900	81,400	87,200	87,100	92,300	86,500	98,900
Bed Conditions							
Gas Velocity In, ft/sec	2.95	2.22	2.44	2.42	2.49	2.40	2.53
Average Bed Density, lb/ft^3[6]	83	87	78	68	62	57	56
Average Bed Temperature, °F	1863	1850	1849	1829	1846	1823	1829
Overhead Gas Compositions, Mol %							
CO	5.8	3.4	3.4	3.1	2.2	3.5	4.4
CO_2	15.6	21.2	23.3	25.0	25.0	23.7	21.2
N_2	78.6	75.4	73.3	71.9	72.8	72.8	74.4

(1) Determined by feeder rpm: dead-burned dolomite, 360*RPM; limestone, 281*RPM; auxiliary fuel, 368*RPM
(2) Determined by weigh scale measurements
(3) Determined by lift line pressure drop measurements
(4) Determined by orifice flow meter measurements
(5) Nitrogen value reflects additional purge to the calcined acceptor standleg
(6) Determined by differential pressure measurements

Table 40-2. REGENERATOR DATA FOR RUN 40A

Date	11/11/76	11/12/76		← 11/13/76 →			← 11/14/76 →			11/15/76
Time	2300	0700	2300	0700	1500	2300	0700	1500	2300	0700
Jacket Steam Make, lb/hr	0	0	0	0	0	0	0	0	0	0
Solids										
Feedstock	← Texas Lignite →									
Feed Rate, lb/hr[1]	1,880	2,090	2,500	2,590	2,090	2,710	2,590	2,170	2,000	1,960
Cyclone Solids Dump, lb/hr	228	57	204	193	252	258	163	195	115	115
Quench Tower Solids, lb/hr	69	54	62	30	22	56	126	52	47	47
Gas Flows[2]										
Boot (Recycle), SCFH	18,700	16,800	15,600	10,900	9,180	7,860	7,220	23,800	10,000	10,500
Boot (Steam), SCFH	16,400	18,500	21,900	25,300	25,400	24,400	22,400	13,200	19,500	18,300
Side (Steam), SCFH	28,800	28,600	26,100	22,300	22,300	23,700	23,400	24,400	21,600	27,600
Side (Air), SCFH	18,500	18,400	11,000	9,510	10,600	9,490	9,420	9,780	9,020	8,510
Purges										
Recycle, SCFH	2,490	1,530	1,940	2,200	2,340	2,450	2,390	1,820	2,090	2,050
Inert, SCFH	160	220	180	270	180	180	160	180	180	180
Nitrogen, SCFH	6,220	4,180	3,120	2,520	3,030	2,740	3,200	3,420	2,740	3,710
Total Flow In, SCFH	91,300	88,200	79,800	73,000	73,000	70,800	68,200	76,600	65,100	70,900
Vent Rate, SCFH	55,000	55,600	46,600	31,600	52,700	53,300	48,900	40,000	44,800	57,000
Bed Conditions										
Boot Velocity, ft/sec	1.78	1.80	1.90	1.80	1.85	1.61	1.43	1.81	1.66	1.49
Char Bed Velocity Inlet, ft/sec	0.86	0.86	0.78	0.70	0.73	0.68	0.64	0.72	0.66	0.68
Boot Density, lb/ft^3[3]	98.0	93.0	75.0	68.0	60	57	45	60	57	57
Char Bed Density, lb/ft^3[3]	45.0	37.0	45.0	44.0	45	45	43	41	42	38
Boot Temperature, °F	1483	1511	1513	1529	1542	1519	1507	1503	1551	1494
Char Bed Temperature, °F	1485	1494	1504	1506	1525	1504	1500	1476	1512	1475
Overhead Gas Compositions, Mol %										
CO	13.4	15.4	13.4	13.2	13.7	13.1	13.2	11.0	12.9	12.5
CO_2	16.5	9.8	13.6	13.4	14.2	13.1	12.5	12.9	10.3	11.5
N_2	33.3	29.9	22.2	21.1	21.2	20.2	20.2	28.4	23.9	30.0
H_2	29.9	36.1	39.7	41.4	41.5	42.1	42.5	36.0	42.8	36.2
CH_4	6.8	8.6	11.0	10.8	9.4	11.5	11.6	11.7	10.0	9.6
H_2O Mole Fraction[4]	28.0	19.7	30.1	34.3	31.8	30.4	31.0	29.6	26.6	26.5

(1) Determined by feeder rpm - 417*RPM
(2) Determined by orifice flow meter measurements
(3) Determined by differential pressure measurements
(4) Calculations based on water-gas shift equilibriums

Table 40-3. GASIFIER DATA FOR RUN 40B (Sheet 1 of 3)

Date	11/15/76		11/16/76				11/17/76			
Time	1500	2300	0700	1500	1900	2300	0300	0700	1130	1500
Jacket Steam Make, lb/hr	0	0	0	0	0	0	0	0	0	0
Solids										
Feedstock	Texas Lignite									
Feed Rate, lb/hr[1]	2,290	2,500	2,500	2,290	2,290	2,290	2,290	2,290	2,290	2,500
Cyclone Solids Dump, lb/hr	281	278	192	219	219	232	240	240	224	224
Quench Tower Solids, lb/hr	79	63	95	66	54	41	36	47	52	58
Gas Flows[2]										
Boot (Recycle), SCFH	12,000	12,600	12,500	9,280	9,030	9,070	8,690	8,390	8,460	8,490
Boot (Steam), SCFH	19,500	19,100	19,300	22,300	23,300	23,300	23,600	23,800	22,600	22,800
Side (Steam), SCFH	27,500	26,800	26,800	26,500	26,600	26,600	26,500	26,500	26,500	26,500
Side (Air), SCFH	18,200	13,800	13,500	11,100	10,900	11,100	11,300	11,100	11,200	11,000
Purges										
Recycle, SCFH	2,130	2,330	1,570	1,980	2,190	2,200	1,880	1,730	1,910	1,620
Inert, SCFH	890	230	230	310	180	260	300	250	430	920
Nitrogen, SCFH	2,950	2,650	2,860	2,740	2,610	2,860	2,820	2,860	2,740	3,730
Total Flow In, SCFH	83,200	77,500	76,800	74,200	74,800	75,400	75,100	74,600	73,800	75,100
Vent Rate, SCFH	52,900	50,000	47,900	45,300	46,700	45,100	44,700	43,000	46,000	45,700
Bed Conditions										
Boot Velocity, ft/sec	1.64	1.63	1.61	1.61	1.64	1.64	1.62	1.62	1.47	1.59
Char Bed Velocity Inlet, ft/sec	0.82	0.77	0.76	0.73	0.73	0.73	0.73	0.72	0.70	0.72
Boot Density, lb/ft^3[3]	54	56	53	56	54	54	53	56	53	54
Char Bed Density, lb/ft^3[3]	40	44	33	43	42	41	41	41	42	46
Boot Temperature, ^oF	1538	1502	1509	1508	1520	1527	1525	1522	1531	1517
Char Bed Temperature, ^oF	1502	1501	1498	1497	1492	1500	1497	1493	1505	1492
Overhead Gas Compositions, Mol %										
CO	13.9	12.8	13.2	12.6	12.2	12.4	12.6	12.0	12.9	12.1
CO_2	12.6	12.7	11.2	11.7	13.6	13.3	13.9	13.8	12.2	11.7
N_2	27.5	24.0	24.1	23.0	22.6	22.4	21.4	21.5	21.7	20.5
H_2	36.8	38.9	39.9	41.6	41.0	41.1	41.6	41.8	42.2	44.0
CH_4	9.1	11.5	11.5	11.0	10.5	10.4	10.4	10.8	10.7	11.6
H_2O Mole Fraction[4]	25.7	28.6	25.9	28.5	31.7	31.3	31.9	33.1	29.3	30.3

(1)
(2) Determined by feeder rpm - 417*RPM
(3) Determined by orifice flow meter measurements
(4) Determined by differential pressure measurements
Calculations based on water-gas shift equilibriums

Table 40-3. GASIFIER DATA FOR RUN 40B (Sheet 2 of 3)

Date	11/17/76	← 11/18/76 →					← 11/19/76 →			11/20/76
Time	2300	0300	0700	1100	1500	2300	0700	1500	2300	0700
Jacket Steam Make, lb/hr	0	0	0	0	0	0	0	0	0	0
Solids										
Feedstock	← Texas Lignite →									
Feed Rate, lb/hr[1]	2,500	2,500	2,500	2,500	2,500	2,290	2,290	2,710	1,880	2,290
Cyclone Solids Dump, lb/hr	272	266	266	266	266	203	227	225	72	72
Quench Tower Solids, lb/hr	59	59	61	59	54	41	62	50	41	57
Gas Flows[2]										
Boot (Recycle), SCFH	8,550	8,400	9,100	9,140	8,750	8,300	8,590	7,230	7,320	7,780
Boot (Steam), SCFH	22,100	20,400	19,300	19,900	19,900	20,000	20,800	19,400	22,000	21,100
Side (Steam), SCFH	26,800	27,100	26,700	26,700	26,800	27,100	27,000	27,000	29,900	30,200
Side (Air), SCFH	11,000	11,300	11,400	11,700	11,900	11,700	11,700	9,270	6,450	4,880
Purges										
Recycle, SCFH	1,760	2,160	2,030	2,080	1,960	1,890	2,070	1,750	1,650	1,650
Inert, SCFH	370	950	280	330	310	960	250	260	280	510
Nitrogen, SCFH	3,640	3,810	3,600	3,600	3,960	2,390	2,560	2,140	2,010	1,750
Total Flow In, SCFH	74,200	74,100	72,400	73,500	73,600	72,300	73,000	67,100	69,600	68,900
Vent Rate, SCFH	44,500	45,700	45,500	47,400	49,400	45,200	46,300	45,800	42,600	39,400
Bed Conditions										
Boot Velocity, ft/sec	1.66	1.63	1.60	1.60	1.61	1.55	1.64	1.55	1.59	1.60
Char Bed Velocity Inlet, ft/sec	0.74	0.73	0.72	0.73	0.73	0.72	0.74	0.70	0.68	0.66
Boot Density, lb/ft^3[3]	56	54	54	56	54	53	53	54	51	51
Char Bed Density, lb/ft^3[3]	48	47	47	47	47	44	44	46	44	48
Boot Temperature, ^oF	1497	1504	1502	1498	1496	1503	1514	1502	1510	1499
Char Bed Temperature, ^oF	1485	1480	1480	1476	1476	1480	1495	1480	1505	1495
Overhead Gas Compositions, Mol %										
CO	11.6	11.9	11.9	11.3	10.4	11.1	11.7	10.8	11.3	12.3
CO_2	13.2	12.9	15.0	12.7	14.0	14.8	13.3	14.6	13.7	13.4
N_2	20.4	20.4	20.1	21.2	23.6	20.8	21.4	18.7	16.4	14.4
H_2	43.1	42.9	41.4	43.2	41.5	42.7	43.3	43.5	48.2	46.7
CH_4	11.6	11.8	11.5	11.5	10.4	10.5	10.2	12.3	10.3	13.1
H_2O Mole Fraction[4]	32.9	32.7	34.2	32.2	35.5	36.0	33.5	39.6	37.7	36.8

(1) Determined by feeder rpm - 417*RPM
(2) Determined by orifice flow meter measurements
(3) Determined by differential pressure measurements
(4) Calculations based on water-gas shift equilibriums

Table 40-3. GASIFIER DATA FOR RUN 40B (Sheet 3 of 3)

Date	11/11/76	11/12/76		11/13/76			11/14/76			11/15/76
Time	2300	0700	2300	0700	1500	2300	0700	1500	2300	0700
Jacket Steam Make, lb/hr	← Instrument Out of Service →									
Solids										
Acceptor Feedstock	← 6 X 8 Minnekahta Limestone →									
Acceptor Makeup, lb/hr[1]	560	840	840	840	840	840	840	840	840	840
Acceptor Withdrawal, lb/hr[2]	634	766	178	902	273	525	348	150	150	290
Acceptor Circulation, lb/hr[3]	12,600	7,580	9,020	8,160	11,100	9,610	6,720	3,420	6,720	3,830
Ash and Attrited Acceptor, lb/hr[2]	148	73	370	523	303	223	223	360	NA	318
Auxiliary Fuel Char, lb/hr[1]	322	358	215	215	215	251	251	609	251	555
Gas Flows[4]										
Acceptor Lift, SCFH	54,800	54,600	54,100	54,200	54,000	54,300	54,200	53,900	54,000	54,300
Char Lift, SCFH	10,200	10,200	10,100	10,000	9,990	10,000	10,100	10,100	10,100	10,100
Air Line										
Recycle, SCFH	32,200	20,700	15,400	0	0	0	15,400	22,500	10,200	41,100
Air, SCFH	65,700	72,100	78,600	78,700	72,200	76,900	80,300	71,500	73,200	69,000
Purges										
Recycle, SCFH	1,740	1,730	1,660	1,570	1,560	1,570	1,720	1,570	1,460	1,480
Inert, SCFH	0	0	0	750	0	0	0	0	0	0
Nitrogen, SCFH[5]	470	470	470	470	470	470	470	470	470	470
Total Flow In, SCFH	165,100	159,800	160,300	145,700	138,200	143,200	162,200	160,000	149,400	176,500
Vent Rate, SCFH	83,400	96,200	107,900	109,900	103,400	109,000	111,100	100,700	101,800	102,100
Bed Conditions										
Gas Velocity In, ft/sec	3.02	2.92	2.95	2.70	2.53	2.64	3.01	2.94	2.76	3.16
Average Bed Density, lb/ft^3[6]	104	96	83	73	59	62	59	57	56	59
Average Bed Temperature, ^oF	1825	1831	1844	1872	1830	1843	1864	1833	1851	1776
Overhead Gas Compositions, Mol %										
CO	1.4	2.7	2.1	3.5	2.2	3.7	3.8	4.8	2.2	2.9
CO_2	20.0	21.6	25.0	24.6	25.9	24.6	24.2	24.6	25.9	22.1
N_2	78.6	75.7	72.9	71.9	71.9	71.7	72.0	70.6	72.0	75.1

(1) Determined by feeder rpm: limestone, 281*RPM; auxiliary fuel, 358*RPM
(2) Determined by weigh scale measurements
(3) Determined by lift line pressure drop measurements
(4) Determined by orifice flow measurements
(5) Nitrogen value reflects additional purge added to the calcined acceptor standleg
(6) Determined by differential pressure measurements

Table 40-4. REGENERATOR DATA FOR RUN 40B (Sheet 1 of 3)

Date	11/15/76		← 11/16/76 →				← 11/17/76 →			
Time	1500	2300	0700	1500	1900	2300	0300	0700	1130	1500
Jacket Steam Make, lb/hr	← Instrument Out of Service →									
Solids										
Acceptor Feedstock	← 6 X 8 Minnekahta Limestone →									
Acceptor Makeup, lb/hr[1]	840	840	840	840	840	840	840	840	840	840
Acceptor Withdrawal, lb/hr[2]	290	382	NA	391	391	655	483	359	367	367
Acceptor Circulation, lb/hr[3]	5,320	5,310	7,280	6,440	6,440	6,170	6,170	5,600	6,730	6,730
Ash and Attrited Acceptor, lb/hr[2]	349	273	392	347	288	288	459	459	367	367
Auxiliary Fuel Char, lb/hr[1]	72	251	215	251	251	251	286	286	286	286
Gas Flows[4]										
Acceptor Lift, SCFH	53,800	54,000	54,200	54,100	53,900	53,800	53,800	53,800	53,800	53,800
Char Lift, SCFH	10,100	10,100	10,200	10,100	10,100	10,100	10,100	10,100	10,100	10,100
Air Line										
Recycle, SCFH	17,300	19,400	18,500	12,300	12,200	12,200	13,200	13,200	13,200	13,200
Air, SCFH	70,500	71,300	77,800	77,500	73,900	74,100	75,800	74,000	73,800	73,700
Purges										
Recycle, SCFH	1,570	1,510	1,470	1,470	1,370	1,910	1,860	1,760	1,760	1,710
Inert, SCFH	490	0	0	750	0	0	510	510	390	70
Nitrogen, SCFH[5]	470	470	470	470	470	470	470	470	470	590
Total Flow In, SCFH	154,200	156,800	162,600	156,700	151,900	152,600	155,700	153,800	153,500	153,200
Vent Rate, SCFH	101,500	108,500	112,800	113,100	105,800	105,400	104,100	104,300	104,200	106,600
Bed Conditions										
Gas Velocity In, ft/sec	2.85	2.90	3.01	2.86	2.79	2.78	2.86	2.82	2.81	2.79
Average Bed Density, lb/ft^3[6]	53	54	53	53	52	52	53	53	52	52
Average Bed Temperature, ^oF	1853	1853	1852	1835	1835	1823	1846	1843	1837	1827
Overhead Gas Compositions, Mol %										
CO	3.1	2.0	6.0	5.1	3.3	3.1	2.2	2.2	2.0	2.4
CO_2	24.6	26.3	23.7	23.7	24.6	25.5	25.0	25.0	25.5	25.0
N_2	72.3	71.7	70.3	71.2	72.2	71.5	72.7	72.7	72.6	72.6

(1)
(2) Determined by feeder rpm: limestone 281*RPM; auxiliary fuel, 358*RPM
(3) Determined by weigh scale measurements
(4) Determined by lift line pressure drop measurements
(5) Determined by orifice flow measurements
(6) Nitrogen value reflects additional purge added to the calcined acceptor standleg
Determined by differential pressure measurements

Table 40-4. REGENERATOR DATA FOR RUN 40B (Sheet 2 of 3)

Date	11/17/76	← 11/18/75 →					← 11/19/76 →			11/20/76
Time	2300	0300	0700	1100	1500	2300	0700	1500	2300	0700
Jacket Steam Make, lb/hr	← Instrument Out of Service →									
Solids										
Acceptor Feedstock	← 6 X 8 Minnekahta Limestone →									
Acceptor Makeup, lb/hr[1]	840	840	840	840	840	840	840	840	840	840
Acceptor Withdrawal, lb/hr[2]	175	409	325	325	420	379	267	486	270	285
Acceptor Circulation, lb/hr[3]	5,880	6,710	5,300	6,710	4,460	5,860	3,880	6,150	7,290	7,570
Ash and Attrited Acceptor, lb/hr[2]	276	249	249	399	399	309	289	295	336	311
Auxiliary Fuel Char, lb/hr[1]	286	286	286	286	286	286	286	394	394	394
Gas Flows[4]										
Acceptor Lift, SCFH	54,100	54,400	54,500	54,500	54,400	54,400	54,300	54,100	54,100	54,100
Char Lift, SCFH	10,100	10,100	10,100	10,100	10,100	10,100	10,200	10,100	10,100	10,200
Air Line										
Recycle, SCFH	12,300	13,400	13,400	12,400	13,400	12,400	13,400	12,300	12,300	13,300
Air, SCFH	73,700	76,600	76,000	76,700	78,700	77,300	72,500	79,500	79,100	83,300
Purges										
Recycle, SCFH	540	540	540	540	290	540	1,370	1,710	490	490
Inert, SCFH	370	360	470	470	440	460	410	320	420	470
Nitrogen, SCFH[5]	590	590	590	590	630	450	450	380	380	380
Total Flow In, SCFH	151,700	156,000	155,600	155,300	158,000	155,200	152,600	158,400	156,900	162,200
Vent Rate, SCFH	105,300	105,700	108,400	109,300	110,800	108,100	102,100	110,200	107,900	112,800
Bed Conditions										
Gas Velocity In, ft/sec	2.77	2.85	2.86	2.83	2.90	2.88	2.80	2.88	2.89	2.97
Average Bed Density, lb/ft^3[6]	52	50	51	52	52	52	50	54	53	52
Average Bed Temperature, ^{o}F	1816	1818	1833	1813	1823	1845	1839	1821	1828	1820
Overhead Gas Compositions, Mol %										
CO	2.2	3.4	4.1	4.3	4.7	3.8	3.0	3.5	2.9	3.4
CO_2	25.5	24.2	24.2	25.0	24.6	25.0	26.3	25.9	26.8	27.6
N_2	72.4	72.4	71.7	70.7	70.7	71.1	70.7	70.6	70.4	69.0

(1) Determined by feeder rpm: limestone, 281*RPM; auxiliary fuel, 358*RPM
(2) Determined by weigh scale measurements
(3) Determined by lift line pressure drop measurements
(4) Determined by orifice flow measurements
(5) Nitrogen value reflects additional purge added to the calcined acceptor standleg
(6) Determined by differential pressure measurements

Table 40-4. REGENERATOR DATA FOR RUN 40B (Sheet 3 of 3)

Date: 10/23/76 - 10/28/76

Screen Size, Wt % Tyler Mesh	Acceptor Dead-Burned[1] Dolomite	Minnekahta Limestone	Screen Size, Wt % Tyler Mesh	Auxiliary Fuel Husky Char	Coal Feedstock Texas[2] Lignite
+6	↓	Tr	+8	22.7	↓
6 X 8	↓	42.3	8 X 10	16.0	↓
8 X 9	1.0	34.5	10 X 14	15.1	↓
9 X 10	↓	18.2	14 X 20	12.7	46.9
10 X 12	43.1	3.8	20 X 28	8.8	↓
12 X 14	26.8	0.7	28 X 35	7.1	↓
14 X 16	↓	0.1	35 X 48	5.9	48.1
16 X 20	26.8	0.1	48 X 65	3.2	↓
20 X 24	↓	0.1	65 X 100	2.8	4.5
24 X 28	1.5	0.1	100 X 200	2.9	↓
-28	1.0	0.1	200 X 325	1.2	↓
			-325	1.6	0.5
Ultimate Analysis, Wt %					
Moisture				6.40	2.36
C				70.77	60.54
H				1.94	4.17
S				0.68	-
N				1.43	1.02
Ash + SO_3				23.28	13.32
Elemental Analysis, Wt %					
SiO_2	1.38	3.38		46.91	51.81
SO_3	0.16	0.12		15.20	12.48
Na_2O	0.07	0.04		2.11	0.08
CaO	58.24	93.52		16.87	19.42
MgO	36.94	1.51		4.25	3.16
K_2O	0.01	0.04		0.47	0.18
Al_2O_3	0.88	0.92		7.75	8.86
Fe_2O_3	1.13	0.37		5.30	3.34
P_2O_5	0.01	0.04		0.04	0.02
TiO_2	0.04	0.10		0.24	0.54

(1) Screen size from Run 37A, analysis from Run 40A
(2) Individual, not composite, sample

Table 40-5. FEEDSTOCK COMPOSITES FOR RUN 40A

Date: 11/11/76 - 11/20/76

Screen Size, Wt % Tyler Mesh	Acceptor Dead-Burned[1] Dolomite	Minnekahta Limestone	Screen Size, Wt % Tyler Mesh	Coal Feedstock Texas Lignite	Auxiliary Fuel Velva Lignite
+6	↓	0.9	+8	0.2	0.2
6 X 8	↓	40.1	8 X 10	0.3	2.0
8 X 9	1.0	29.5	10 X 14	5.1	13.8
9 X 10	↓	26.0	14 X 20	7.7	14.5
10 X 12	43.1	2.9	20 X 28	10.1	12.5
12 X 14	26.8	0.5	28 X 35	24.5	21.0
14 X 16	↓	0.1	35 X 48	19.4	17.6
16 X 20	26.8	Tr	48 X 65	11.6	9.2
20 X 24	↓	Tr	65 X 100	8.3	4.8
24 X 28	1.5	Tr	100 X 200	7.6	3.1
-28	1.0	0.1	200 X 325	2.8	0.7
			-325	2.2	0.4
Ultimate Analysis, Wt %					
Moisture				0.7	8.49
C				63.39	59.10
H				4.48	4.84
S				0.89	0.73
N				0.92	0.41
Ash + SO_3				13.86	6.61
Elemental Analysis, Wt %					
SiO_2	1.38	3.85		46.54	22.59
SO_3	0.16	0.02		12.84	12.16
Na_2O	0.07	0.11		0.38	1.32
CaO	58.24	93.63		22.53	36.22
MgO	36.94	1.11		3.77	10.08
K_2O	0.1	0.08		0.20	0.27
Al_2O_3	0.88	0.64		9.80	11.52
Fe_2O_3	1.13	0.33		4.01	4.97
P_2O_5	0.01	0.03		0.02	0.12
TiO_2	0.04	0.11		0.70	0.52

[1] Screen size from Run 37A, analysis from Run 38C

Table 40-6. FEEDSTOCK COMPOSITES FOR RUN 40B

Date	10/26/76	← 10/27/76 →						← 10/28/76 →			
Time	1530	2000	0030	0400	0815	1230	1600	2000	0000	0400	1200	1615
Screen Size, Wt % Tyler Mesh												
+6		↓	↓	↓	0.2	↓	↓	↓	↓	0.5	0.7	0.9
6 X 8		0.1	0.4	1.8	11.6	16.3	18.0	31.5	11.1	14.8	15.4	21.2
8 X 9	↓	0.3	↓	↓	10.3	↓	↓	↓	↓	18.0	17.4	19.4
9 X 10	10.8	7.6	4.4	9.1	14.1	23.1	25.7	31.9	24.0	19.5	14.9	16.6
10 X 12	↓	42.3	↓	↓	27.3	↓	↓	↓	↓	19.2	20.4	16.9
12 X 14	73.0	32.9	80.6	75.2	21.0	44.3	40.4	27.9	45.9	14.3	14.8	12.2
14 X 16	↓	11.7	↓	↓	10.6	↓	↓	↓	↓	6.9	8.3	6.6
16 X 20	15.4	3.0	12.4	12.2	3.0	13.6	13.5	7.4	14.1	2.6	3.9	3.1
20 X 24	↓	0.8	↓	↓	0.7	↓	↓	↓	↓	1.4	1.2	1.2
24 X 28	0.5	0.1	0.5	0.9	0.1	1.4	1.1	0.6	2.6	0.4	0.6	0.6
-28	0.4	1.2	1.7	0.9	1.1	1.4	1.1	0.6	2.3	2.4	2.4	1.2
Elemental Analysis, Wt %												
Sulfide		0.08			0.09	0.08			-	0.10	0.12	0.10
SiO_2		3.02			6.06	6.13			7.64	9.56	11.11	10.04
SO_3		0.19			1.16	1.27			1.88	1.67	2.09	2.09
Na_2O		0.05			0.04	0.03			0.03	0.15	0.24	0.17
% Calcine Weight Change		+0.3			+0.4	+0.4			+0.7	+0.4	+0.9	+1.3

Table 40-7. CIRCULATED, CALCINED ACCEPTOR FOR RUN 40A

Date	11/11/76	← 11/12/76 →			← 11/13/76 →			← 11/14/76 →			← 11/15/76 →			← 11/16/76 →		
Time	1140	0015	0750	1600	0015	0820	1600	0000	0755	1600	0005	0800	1600	0000	0800	1600
Screen Size, Wt %																
Tyler Mesh																
+6	↓	↓	0	↓	↓	0.3	↓	↓	0.2	↓	↓	0.4	↓	↓	0.8	↓
6 X 8	0.4	1.5	1.5	10.5	16.5	13.3	31.7	19.5	26.8	32.7	27.6	19.4	30.8	17.4	30.2	29.3
8 X 9	↓	↓	2.7	↓	↓	13.8	↓	↓	20.8	↓	↓	27.6	↓	↓	28.3	↓
9 X 10	8.5	16.7	13.8	24.2	22.6	17.5	30.5	33.4	15.8	40.0	36.9	20.5	38.9	36.6	18.4	42.9
10 X 12	↓	↓	44.6	↓	↓	27.0	↓	↓	15.2	↓	↓	12.8	↓	↓	9.7	↓
12 X 14	76.9	72.4	25.2	50.6	52.0	16.6	28.9	23.6	9.6	21.5	20.9	7.8	18.5	25.8	4.8	19.1
14 X 16	↓	↓	8.8	↓	↓	7.3	↓	↓	5.3	↓	↓	4.3	↓	↓	2.5	↓
16 X 20	10.9	8.1	1.7	11.7	7.3	2.3	7.3	10.3	2.6	5.6	6.9	3.2	7.4	7.5	1.7	4.9
20 X 24	↓	↓	0.1	↓	↓	0.6	↓	↓	1.1	↓	↓	1.2	↓	↓	0.8	↓
24 X 28	0.9	0.4	0	1.0	0.5	0.2	0.7	2.1	0.7	0.3	1.8	0.3	2.1	2.2	0.4	1.6
-28	2.4	0.9	1.5	1.9	1.0	1.2	0.9	6.0	1.8	Tr	5.9	2.6	2.3	10.4	2.4	2.1
Elemental Analysis, Wt %																
Sulfide			0.05			-			0.51			-			0.68	
SiO_2			7.44			10.10			10.16			9.32			7.28	
SO_3			0.22			1.50			2.46			3.54			2.20	
Na_2O			0.08			0.04			0.04			0.04			0.04	
% Calcine Weight Change			-0.2			-0.4			-0.6			-14.3			-0.3	

Table 40-8. CIRCULATED, CALCINED ACCEPTOR FOR RUN 40B (Sheet 1 of 2)

Date	11/16/76	← 11/17/76 →					← 11/18/76 →					← 11/19/76 →			11/20/76	
Time	2000	0000	0400	0800	1150	1640	0030	0400	0800	1200	1600	0000	0745	1545	0000	0845
Screen Size, Wt % Tyler Mesh																
+6	+	+	+	0.6	+	0.7	1.1	+	0.4	+	0.4	1.2	2.0	1.2	1.7	3.2
6 X 8	35.3	22.1	25.9	21.9	21.3	13.7	21.9	17.6	26.6	32.2	24.8	22.9	26.1	24.3	27.4	28.7
8 X 9	+	+	+	29.2	+	21.9	27.8	+	28.1	+	27.1	27.3	28.9	25.8	29.4	27.6
9 X 10	43.7	44.2	44.4	22.2	39.1	21.2	21.5	51.0	20.7	38.6	18.8	21.8	20.9	19.8	20.3	17.9
10 X 12	+	+	+	11.5	+	13.5	12.6	+	10.8	+	11.5	12.7	10.8	10.6	9.8	8.5
12 X 14	12.6	20.0	20.5	5.7	30.6	9.0	6.1	17.2	6.1	15.0	6.8	6.3	5.6	6.8	5.0	5.0
14 X 16	+	+	+	2.4	+	3.8	2.4	+	2.7	+	3.3	2.5	2.2	3.5	0.9	2.0
16 X 20	5.2	6.0	4.8	1.9	4.1	5.1	2.4	4.9	2.1	7.3	3.0	2.2	1.4	3.2	1.5	2.2
20 X 24	+	+	+	1.0	+	3.4	1.6	+	1.2	+	2.0	1.4	0.8	2.5	1.1	1.6
24 X 28	1.4	2.3	1.7	0.4	1.5	2.1	0.6	2.0	0.1	3.6	0.8	0.4	0	0.9	0.2	0.8
-28	1.8	5.3	2.7	3.1	3.4	5.4	2.0	7.3	1.3	3.3	1.4	1.4	1.2	1.4	2.8	2.5
Elemental Analysis, Wt %																
Sulfide		0.65		-		-	-		-		-	-	-	-		-
SiO_2		11.70		10.10		8.48	11.52		9.04		8.16	5.46	8.36	6.47		10.05
SO_3		2.36		2.03		1.63	1.84		2.24		2.25	2.04	2.08	1.67		1.70
Na_2O		0.05		0.03		0.03	0.03		0.01		0.01	0.01	0.02	0.02		0.04
% Calcine Weight Change		+0.2		+0.7		-0.1	+0.8		+0.9		+0.7	+1.2	+0.7	-0.2		+0.7

Table 40-8. CIRCULATED, CALCINED ACCEPTOR FOR RUN 40B (Sheet 2 of 2)

Date	10/26/76		← 10/27/76 →					10/28/76	
Time	1600	2000	0000	0400	0800	1200	1550	1245	1605
Screen Size, Wt % Tyler Mesh									
+6	↓	↓	↓	↓	0.1	0.2	0.2	0.5	0.6
6 X 8	0.1	0.1	0.6	3.5	8.1	10.9	10.7	23.7	22.2
8 X 9	↓	0.7	↓	4.8	7.7	6.8	9.4	14.9	15.8
9 X 10	1.0	6.8	6.6	10.0	15.0	12.5	12.2	17.4	16.6
10 X 12	↓	36.7	↓	34.3	29.2	27.0	25.6	15.2	16.0
12 X 14	71.2	31.3	68.2	26.8	23.0	21.3	20.8	11.7	12.3
14 X 16	↓	15.8	↓	12.7	11.8	13.3	13.4	8.3	7.7
16 X 20	24.6	6.8	21.5	6.1	3.4	3.7	3.9	2.8	2.9
20 X 24	↓	1.2	↓	1.0	0.9	1.8	1.9	1.0	1.4
24 X 28	1.8	0.2	2.5	0.3	0.3	0.5	0.5	0.4	0.5
-28	1.2	0.5	0.5	0.4	0.5	2.0	1.8	4.0	4.0
Particle Density, lb/ft^3		194		170	153	147	139	119	126
% Calcine Weight Change		-1.7		-4.7				-11.5	-11.5
Activity					0.14	0.10	0.12	0.10	0.20
Elemental Analysis, Wt %									
Sulfide		-		-		-	-	-	-
SiO_2		5.13		7.95		6.07	6.42	8.72	9.90
SO_3		0.40		1.26		1.36	1.48	2.39	2.27
Na_2O		0.10		0.07		0.04	0.03	0.05	0.08
CaO		54.92		56.99		64.38	65.48	78.55	77.78
MgO		35.44		29.19		25.17	23.29	6.07	5.61
K_2O		0.03		0.02		0.01	0.01	0.02	0.02
Al_2O_3		2.17		2.01		1.66	1.23	2.12	2.10
Fe_2O_3		2.42		2.46		1.72	1.55	1.75	1.99
P_2O_5		0.02		0.02		0.02	0.02	0.03	0.03
TiO_2		0.20		0.21		0.20	0.20	0.18	0.20

Table 40-9. CIRCULATED, RECARBONATED ACCEPTOR FOR RUN 40A

Date	11/11/76	← 11/12/76 →			← 11/13/76 →			← 11/14/76 →			
Time	1330	0015	0800	1600	0005	0800	1600	0002	0730	1545	2345
Screen Size, Wt % Tyler Mesh											
+6	↓	↓	0	↓	↓	Tr	↓	↓	Tr	↓	↓
6 X 8	0.2	0.2	3.4	7.4	16.5	10.8	23.2	10.1	17.6	23.9	22.7
8 X 9	↓	↓	4.1	↓	↓	14.0	↓	↓	22.0	↓	↓
9 X 10	11.2	4.9	12.1	15.8	22.6	16.4	29.3	28.0	17.6	36.1	36.1
10 X 12	↓	↓	34.2	↓	↓	24.4	↓	↓	15.7	↓	↓
12 X 14	66.5	78.4	25.5	58.8	52.0	17.6	31.9	40.8	11.4	24.7	22.6
14 X 16	↓	↓	13.8	↓	↓	9.5	↓	↓	7.2	↓	↓
16 X 20	18.9	14.9	4.7	15.3	7.3	4.1	12.3	14.8	4.5	10.9	10.6
20 X 24	↓	↓	1.1	↓	↓	1.5	↓	↓	1.6	↓	↓
24 X 28	1.0	0.9	0.5	2.1	0.5	0.8	2.4	3.4	0.7	3.1	5.3
-28	2.2	0.6	0.5	0.6	1.0	0.9	0.9	3.0	1.8	1.3	2.7
Particle Density, lb/ft^3			147	139	158	131	110	120	106	113	114
% Calcine Weight Change			-2.5			-5.8			-5.6		
Activity			0.21	0.08	0.10	0.09	0.15	0.12	0.15	0.18	0.14
Elemental Analysis, Wt %											
S^{-2}											
SiO_2			4.55			9.01			8.82		
SO_3			0.32			1.22			1.69		
Na_2O			0.02			0.02			0.02		
CaO			56.68			68.35			72.37		
MgO			35.49			18.82			14.37		
K_2O			0.01			0.01			0.01		
Al_2O_3			1.28			1.28			1.45		
Fe_2O_3			1.60			1.60			1.12		
P_2O_5			0.02			0.02			0.02		
TiO_2			0.08			0.09			0.06		

Table 40-10. CIRCULATED, RECARBONATED ACCEPTOR FOR RUN 40B (Sheet 1 of 3)

Date	11/15/76		← 11/16/76 →				← 11/17/76 →				
Time	1200	1600	0005	0845	1600	2000	0000	0355	0800	1200	1600
Screen Size, Wt % Tyler Mesh											
+6	↓	↓	↓	0.3	0.2	↓	0.1	↓	0.1	↓	0.4
6 X 8	16.6	27.1	17.8	23.9	17.2	24.4	15.3	18.6	15.1	22.5	21.6
8 X 9	22.3	↓	↓	26.3	25.5	↓	25.1	↓	23.3	↓	29.2
9 X 10	18.5	38.9	37.5	18.9	20.2	41.9	20.3	40.6	20.5	44.8	19.9
10 X 12	12.6	↓	↓	10.7	12.9	↓	12.2	↓	12.7	↓	11.4
12 X 14	9.2	18.2	26.0	6.2	7.3	18.3	6.9	22.9	7.2	19.5	5.7
14 X 16	6.6	↓	↓	4.3	4.5	↓	4.6	↓	4.1	↓	3.1
16 X 20	6.1	8.8	8.9	3.9	4.5	8.4	5.0	8.7	4.7	6.8	3.1
20 X 24	3.7	↓	↓	2.4	3.2	↓	4.1	↓	3.8	↓	2.3
24 X 28	2.3	4.6	7.7	1.6	2.4	4.3	3.3	5.2	3.3	3.7	1.7
-28	2.1	2.3	2.2	1.5	2.1	2.7	3.0	4.0	5.3	2.6	1.7
Particle Density, lb/ft^3	120	108	115	109		110	110	114	109	109	110
% Calcine Weight Change	-13.3			-8.6			-8.2				
Activity	0.27	0.15	0.17	0.20		0.16	0.17	0.17	0.16	0.16	0.17
Elemental Analysis, Wt % S-2											
SiO_2	9.03			9.24			10.74	11.69			9.52
SO_3	1.40			2.45			2.35	2.48			1.87
Na_2O	0.03			0.08			0.03	0.04			0.05
CaO	85.02			82.17			81.58	79.10			83.70
MgO	1.95			2.85			2.49	3.64			1.90
K_2O	0.02			0.03			0.02	0.03			0.03
Al_2O_3	1.47			1.53			1.77	1.85			1.75
Fe_2O_3	1.03			0.94			1.02	0.97			0.94
P_2O_5	0.03			0.03			0.03	0.02			0.03
TiO_2	0.06			0.06			0.09	0.11			0.11

Table 40-10. CIRCULATED, RECARBONATED ACCEPTOR FOR RUN 40B (Sheet 2 of 3)

Date	← 11/18/76 →					← 11/19/76 →			11/20/76	
Time	0000	0400	0800	1200	1600	0000	0800	1600	0000	0800
Screen Size, Wt % Tyler Mesh										
+6	0.7	↓	0.7	↓	0.6	0.6	Tr	0.2	0.8	0.9
6 X 8	19.1	23.9	22.6	24.0	20.0	21.5	22.6	22.3	18.7	24.3
8 X 9	25.7	↓	24.7	↓	25.0	27.9	26.1	26.5	39.8	27.8
9 X 10	21.1	45.4	20.1	41.5	21.3	22.3	21.5	20.6	15.0	20.7
10 X 12	11.8	↓	10.5	↓	12.5	12.7	11.7	11.6	7.8	10.9
12 X 14	6.2	19.8	6.5	17.2	6.5	6.3	6.3	5.9	4.0	5.5
14 X 16	3.8	↓	3.7	↓	4.2	3.1	3.2	3.2	2.3	3.0
16 X 20	4.0	6.4	3.7	8.6	3.8	2.6	3.1	3.4	2.7	2.7
20 X 24	3.1	↓	3.0	↓	2.9	1.6	2.5	2.6	2.5	1.9
24 X 28	2.4	1.9	2.0	5.5	1.8	0.9	1.6	1.9	2.4	1.2
-28	2.1	2.6	2.4	3.1	1.4	0.7	1.4	1.8	4.1	1.1
Particle Density, lb/ft^3	111	111	111	111	112	112	111	114	109	108
% Calcine Weight Change	-9.9		-9.5				-9.6		-8.0	-8.5
Activity	0.18	0.17	0.19	0.20	0.21	0.17	0.15	0.17	0.16	0.15
Elemental Analysis, Wt %										
S^{-2}										
SiO_2	10.26		10.37		9.18	8.83	8.44	8.59	9.21	9.27
SO_3	2.05		2.40		2.76	2.55	2.01	1.72	1.92	1.96
Na_2O	0.02		0.03		0.02	0.02	0.01	0.02	0.02	0.02
CaO	83.37		83.35		84.30	84.72	86.44	86.21	85.42	86.06
MgO	1.82		1.36		1.18	1.08	0.97	1.12	1.08	1.15
K_2O	0.02		0.02		0.02	0.02	0.01	0.01	0.02	0.01
Al_2O_3	1.50		1.38		1.60	1.82	1.22	1.42	1.35	0.94
Fe_2O_3	0.90		0.83		0.75	0.71	0.66	0.68	0.75	0.58
P_2O_5	0.03		0.02		0.02	0.02	0.03	0.03	0.03	0.02
TiO_2	0.12		0.10		0.10	0.10	0.10	0.10	0.06	0.06

Table 40-10. CIRCULATED, RECARBONATED ACCEPTOR FOR RUN 40B (Sheet 3 of 3)

Date	10/26/76		← 10/27/76 →						← 10/28/76 →					
Time	2000		0400		1200		2010		0400		1200		1945	
Sample	Mix	Accep.	Mix	Accep.	Mix	Accep.	Mix	Accep.	Mix	Accep.	Mix	Accep.	Mix	Accep.
Screen Size, Wt %														
Tyler Mesh														
+8	0.2	↓	1.8	↓	3.4	↓	6.8	↓	4.3	↓	6.1	↓	3.8	↓
8 X 9	↓	1.6	↓	8.8	↓	21.7	↓	42.9	↓	21.1	↓	33.0	↓	28.3
9 X 10	3.6	↓	4.1	↓	9.2	↓	12.4	↓	11.0	↓	15.3	↓	10.0	↓
10 X 12	↓	34.4	↓	29.4	↓	22.8	↓	17.9	↓	19.1	↓	18.0	↓	14.1
12 X 14	30.4	19.7	22.7	14.7	17.1	10.9	15.9	6.0	12.7	5.9	14.0	6.0	9.1	4.3
14 X 20	13.7	19.7	10.8	17.6	6.7	13.0	7.5	10.7	8.0	13.2	8.5	10.0	6.5	10.9
20 X 28	6.6	4.9	6.3	5.9	4.7	7.6	3.6	7.1	7.1	9.2	7.3	9.0	9.0	12.0
28 X 35	8.2	↓	5.7	↓	7.9	↓	1.2	↓	7.4	↓	10.4	↓	9.3	↓
35 X 48	22.6	↓	23.0	↓	22.0	↓	25.5	↓	22.8	↓	17.5	↓	25.4	↓
48 X 65	6.8	19.7	9.0	23.5	2.7	23.9	4.1	15.5	10.2	30.9	8.9	23.5	10.8	29.3
65 X 80	↓		↓		↓	Tr	↓		↓	0.7	↓	0.5	↓	1.1
80 X 100	3.2		9.4		18.7	↓	13.5		8.5	↓	6.8	↓	8.0	↓
100 X 200	3.7		4.8		6.3	↓	6.0		5.0	↓	3.9	↓	5.6	↓
200 X 325	0.6		0.9		1.3	↓	1.6		1.4	↓	0.8	↓	1.5	↓
-325	0.5		1.4		Tr	Tr	2.0		1.6	Tr	0.4	Tr	1.0	Tr
% Acceptor	50.7		55.7		56.6		66.2		59.1		71.7		61.9	
% Ash/Char	21.52		25.92		27.64		24.78		27.53		24.24		20.45	
Elemental Analysis, Wt %														
SiO_2	37.35		47.01										47.15	
SO_3	9.40		8.06										7.63	
Na_2O	1.76		0.85										0.39	

Table 40-11. GASIFIER CHAR BED MATERIAL FOR RUN 40A

Date	11/11/76		← 11/12/76 →						← 11/13/76 →			
Time	1330		0015		0800		1800		0015		0800	
Sample	S-13B[1]		S-13B		S-13B		S-13C[2]		S-13B		S-13C	
	Mix	Accep.	Mix	Accep.	Mix	Accep.	Mix	Accep.	Mix	Accep.	Mix	Accep.
Screen Size, Wt %												
Tyler Mesh												
+8		↓	0.3	↓	0.8	↓	1.5	↓	4.1	↓	5.3	↓
8 X 9	↓	1.2	↓	2.2	↓	6.3	↓	10.3	↓	18.0	↓	32.9
9 X 10	1.3	↓	2.3	↓	2.9	↓	8.1	↓	7.2	↓	11.9	↓
10 X 12	↓	41.9	↓	44.5	↓	35.7	↓	35.5	↓	33.6	↓	22.2
12 X 14	21.7	18.6	29.8	16.8	27.9	13.5	21.6	14.0	33.9	13.3	20.8	8.2
14 X 20	11.1	18.6	13.5	13.9	9.0	15.1	10.4	13.1	11.5	13.3	8.2	10.1
20 X 28	8.2	2.3	6.9	4.4	4.2	4.0	8.8	5.6	5.1	6.2	5.8	7.6
28 X 35	3.6	↓	4.4	↓	0.1	↓	6.6	↓	0.1	↓	0.1	
35 X 48	28.4	↓	23.4	↓	27.3	↓	23.3	↓	22.6	↓	26.8	↓
48 X 65	11.0	16.3	9.6	17.5	14.6	23.0	9.4	20.6	7.1	15.6	9.3	19.0
65 X 80	↓	1.2	↓	0.7	↓	1.6	↓	0.9	↓	Tr	↓	0.6
80 X 100	8.7	↓	6.5	↓	8.0	↓	6.6	↓	4.8	↓	6.7	
100 X 200	5.3	↓	2.7	↓	3.5	↓	3.3	↓	2.6	↓	3.6	
200 X 325	0.6	↓	0.3	↓	1.8	↓	0.4	↓	0.4	↓	0.6	
-325	0.2	Tr	0.2	Tr	Tr	0.8	Tr	Tr	0.7	Tr	0.7	
% Acceptor	39.2		55.7		56.1		51.5		65.8		59.1	
% Ash + SO_3 in Char	18.7		21.85		23.10		22.25		18.63		9.0	
Ash Elemental Analysis, Wt %												
SiO_2	36.54				45.52		45.47				47.91	
SO_3	9.99				6.86		5.76				6.41	
Na_2O	2.61				1.08		1.38				0.56	

(1) S-13B sample from the middle of the char bed
(2) S-13C sample from the bottom of the char bed in the transition section

Table 40-12. GASIFIER CHAR BED MATERIAL FOR RUN 40B (Sheet 1 of 6)

Date	11/13/76		← 11/14/76 →								11/15/76	
Time	1600		0010		0730		1600		2340		1200	
Sample	S-13B		S-13B		S-13B		S-13B[1]		S-13B		S-13B	
	Mix	Accep.	Mix	Accep.	Mix	Accep.	Mix	Accep.	Mix	Accep.	Mix	Accep.
Screen Size, Wt %												
Tyler Mesh												
+8	15.9	↓	7.8	↓	11.6	↓	12.0	↓	8.2	↓	4.6	↓
8 X 9	↓	46.9	↓	27.3	↓	30.1	↓	27.5	↓	34.9	↓	27.4
9 X 10	20.0	↓	12.2	↓	18.7	↓	18.6	↓	13.4	↓	11.1	↓
10 X 12	↓	22.8	↓	20.8	↓	16.7	↓	17.6	↓	17.0	↓	15.1
12 X 14	21.0	6.2	21.8	7.8	12.1	6.0	15.0	5.9	16.0	4.6	10.8	3.8
14 X 20	7.1	8.0	8.6	11.7	6.2	9.7	6.8	11.8	6.0	8.5	6.1	8.5
20 X 28	4.8	4.9	6.1	9.7	6.8	10.6	6.3	13.7	5.7	9.3	7.6	16.0
28 X 35	0.3	↓	11.6	↓	11.8	↓	12.7	↓	13.7	↓	17.7	↓
35 X 48	17.0	↓	13.9	↓	13.3	↓	12.2	↓	12.4	↓	16.5	↓
48 X 65	5.9	11.1	8.0	22.7	8.6	24.5	7.7	23.5	8.3	25.6	10.6	29.2
65 X 80	↓		↓		↓	1.4	-	0	↓	Tr	↓	0
80 X 100	4.6		5.9		6.5	↓	5.9	↓	7.5	↓	8.3	↓
100 X 200	2.6		3.4		3.4	↓	2.5	↓	5.2	↓	4.4	↓
200 X 325	0.3		0.6		0.6	↓	0.1	↓	1.1	↓	0.8	↓
-325	0.5		0.1		0.5	0.9	0.1	0	2.3	Tr	1.4	0
% Acceptor	73.6		64.1		63.0		S9.8		58.4		51.6	
% Ash + SO_3 in Char	21.1		26.2		18.1		18.07		21.20		19.42	
Ash Elemental Analysis, Wt %												
SiO_2					48.37		47.75				48.12	
SO_3					7.16		5.93				6.59	
Na_2O					0.22		0.32				0.19	

(1) S-13B sample from the middle of the char bed
(2) S-13C sample from the bottom of the char bed in the transition section

Table 40-12. GASIFIER CHAR BED MATERIAL FOR RUN 40B (Sheet 2 of 6)

Date	← 11/15/76 →				← 11/16/76 →					
Time	1800		2340		0845		1600		1800	
Sample	S-13C[1]		S-13B		S-13B		S-13B		S-13C	
	Mix	Accep.	Mix	Accep.	Mix	Accep.	Mix	Accep.	Mix	Accep.
Screen Size, Wt %										
Tyler Mesh										
+8	12.0	↓	6.3	↓	10.0	↓	7.5	↓	6.2	↓
8 X 9	↓	36.6	↓	33.6	↓	33.0	↓	39.4	↓	39.0
9 X 10	18.0	↓	17.1	↓	20.6	↓	16.8	↓	18.7	↓
10 X 12	↓	18.7	↓	19.5	↓	18.4	↓	19.7	↓	22.0
12 X 14	12.3	4.1	12.5	3.9	12.0	5.0	11.6	4.2	15.5	3.7
14 X 20	6.6	9.8	5.8	8.6	6.2	8.9	5.9	8.5	7.4	8.5
20 X 28	7.7	9.8	5.6	10.9	7.4	12.3	6.9	9.9	8.7	9.8
28 X 35	14.3	↓	14.6	↓	12.5	↓	12.6	↓	16.3	↓
35 X 48	12.9	↓	13.3	↓	11.6	↓	10.7	↓	12.4	↓
48 X 65	7.7	21.1	8.7	23.4	7.2	20.7	6.3	18.3	6.6	17.1
65 X 80	↓	0	↓	0	↓	1.1	↓	0	↓	0
80 X 100	6.0	↓	7.8	↓	6.5	↓	5.2	↓	3.8	↓
100 X 200	2.4	↓	5.7	↓	4.0	↓	15.9	↓	3.8	↓
200 X 325	0.2	↓	1.1	↓	0.8	↓	0.3	↓	0.3	↓
-325	Tr	0	1.7	0	1.3	0.6	0.4	0	0.4	0
% Acceptor	61.9		59.7		61.4		63.4		69.2	
% Ash + SO_3 in Char	18.60		24.30		18.37		20.70		14.51	
Ash Elemental Analysis, Wt %										
SiO_2	48.04				43.71		46.18		44.76	
SO_3	7.17				7.95		7.33		8.37	
Na_2O	0.33				0.18		0.32		0.24	

(1) S-13B sample from the middle of the char bed
(2) S-13C sample from the bottom of the char bed in the transition section

Table 40-12. GASIFIER CHAR BED MATERIAL FOR RUN 40B (Sheet 3 of 6)

Date	11/16/76		← 11/17/76 →							
Time	2345		0345		0800		1200		1845	
Sample	S-13B		S-13B[1]		S-13B		S-13B		S-13C[2]	
	Mix	Accep.	Mix	Accep.	Mix	Accep.	Mix	Accep.	Mix	Accep.
Screen Size, Wt %										
Tyler Mesh										
+8	4.2	↓	3.4	↓	4.5	↓	5.5	↓	5.0	↓
8 X 9	↓	27.5	↓	30.7	↓	30.5	↓	28.9	↓	29.6
9 X 10	13.7	↓	12.3	↓	16.3	↓	17.7	↓	16.4	↓
10 X 12	↓	21.1	↓	17.2	↓	16.1	↓	18.1	↓	18.4
12 X 14	14.3	4.2	16.9	4.3	14.8	4.0	12.2	4.0	10.4	3.9
14 X 20	6.2	9.9	6.8	9.2	6.5	9.2	6.1	10.1	5.9	9.2
20 X 28	7.3	12.7	7.4	12.9	8.2	14.4	7.6	13.4	7.7	13.8
28 X 35	15.9	↓	17.4	↓	15.0	↓	13.4	↓	15.9	↓
35 X 48	13.9	↓	13.4	↓	13.0	↓	19.2	↓	14.3	↓
48 X 65	8.6	24.6	7.8	25.2	7.8	25.3	6.7	25.5	9.1	25.0
65 X 80	↓	Tr	↓	0.6	↓	0.6	↓	Tr	↓	
80 X 100	7.7	↓	6.5	↓	7.0	↓	5.7	↓	8.1	
100 X 200	5.1	↓	4.7	↓	4.4	↓	3.6	↓	4.9	
200 X 325	1.1	↓	0.9	↓	0.8	↓	0.8	↓	0.9	
-325	2.1	Tr	2.5	Tr	1.7	Tr	1.5	Tr	1.4	
% Acceptor	59.0		61.8		59.8		59.6		57.8	
% Ash + SO_3 in Char	20.84		23.02		19.03		22.59		21.46	
Ash Elemental Analysis, Wt %										
SiO_2					43.85				40.45	
SO_3					7.50				7.82	
Na_2O					0.16				0.33	

(1) S-13B sample from the middle of the char bed
(2) S-13C sample from the bottom of the char bed in the transition section

Table 40-12. GASIFIER CHAR BED MATERIAL FOR RUN 40B (Sheet 4 of 6)

Date	← 11/18/76 →									
Time	0000		0405		1200		1600		1800	
Sample	S-13B								S-13C	
	Mix	Accep.	Mix	Accep.	Mix	Accep.	Mix	Accep.	Mix	Accep.
Screen Size, Wt %										
Tyler Mesh										
+8	9.0	↓	5.5	↓	11.0	↓	8.1	↓	7.9	↓
8 X 9	↓	34.8	↓	29.6	↓	46.8	↓	28.9	↓	41.2
9 X 10	25.0	↓	18.2	↓	24.6	↓	17.7	↓	16.5	↓
10 X 12	↓	20.5	↓	19.4	↓	22.3	↓	20.3	↓	23.5
12 X 14	15.6	3.6	11.7	4.6	15.0	4.3	11.9	4.6	14.8	4.6
14 X 20	6.1	9.8	6.1	8.3	6.9	6.4	6.2	10.5	7.2	8.5
20 X 28	6.7	11.6	6.2	13.9	7.0	7.4	8.5	16.4	9.5	10.5
28 X 35	12.7	↓	16.2	↓	12.0	↓	17.7	↓	17.6	↓
35 X 48	9.3	↓	12.9	↓	9.1	↓	13.9	↓	7.9	↓
48 X 65	5.4	19.6	8.0	24.1	5.4	12.8	7.5	18.4	8.1	11.8
65 X 80	↓	Tr	↓	Tr	↓	Tr	↓	0.7	↓	Tr
80 X 100	4.7	↓	7.1	↓	4.8	↓	6.0	↓	6.8	↓
100 X 200	3.1	↓	5.0	↓	3.1	↓	2.4	↓	3.3	↓
200 X 325	0.7	↓	1.1	↓	0.5	↓	0.1	↓	0.3	↓
-325	1.7	Tr	1.9	Tr	0.5	Tr	0.1	Tr	0.1	Tr
% Acceptor	64.8		61.9		69.8		61.7		70.8	
% Ash + SO_3 in Char	24.23		18.89		19.23		15.75		14.21	
Ash Elemental Analysis, Wt %										
SiO_2									44.73	
SO_3									6.83	
Na_2O									0.31	

(1) S-13B sample from the middle of the char bed
(2) S-13C sample from the bottom of the char bed in the transition section

Table 40-12. GASIFIER CHAR BED MATERIAL FOR RUN 40B (Sheet 5 of 6)

Date	← 11/19/76 →						← 11/20/76 →			
Time	0000		0800		1800		0000		0800	
Sample	S-13B[1]		S-13B		S-13C[2]		S-13B		S-13B	
	Mix	Accep.	Mix	Accep.	Mix	Accep.	Mix	Accep.	Mix	Accep.
Screen Size, Wt %										
Tyler Mesh										
+8	8.4	↓	6.7	↓	3.4	↓	10.9	↓	9.9	↓
8 X 9	↓	25.0	↓	33.0	↓	38.8	↓	33.9	↓	40.3
9 X 10	11.8	↓	12.3	↓	17.0	↓	20.0	↓	19.3	↓
10 X 12	↓	18.5	↓	17.5	↓	15.8	↓	22.8	↓	22.6
12 X 14	16.0	3.7	12.1	4.1	11.6	3.6	14.1	4.2	15.5	3.2
14 X 20	3.4	9.3	5.8	8.2	6.0	8.2	5.9	7.9	5.4	7.3
20 X 28	3.8	14.8	7.1	12.4	7.7	13.8	7.7	11.1	6.1	9.7
28 X 35	18.5	↓	18.6	↓	16.9	↓	13.3	↓	12.6	↓
35 X 48	13.3	↓	15.5	↓	13.5	↓	10.9	↓	11.2	↓
48 X 65	8.8	28.7	9.3	24.7	7.7	19.4	6.4	19.6	6.5	16.9
65 X 80	↓	Tr	↓	Tr	↓	0.5	↓	0.5	↓	Tr
80 X 100	7.8	↓	7.5	↓	6.6	↓	5.7	↓	6.1	↓
100 X 200	5.7	↓	4.4	↓	3.4	↓	3.3	↓	4.9	↓
200 X 325	1.1	↓	0.6	↓	0.6	↓	0.8	↓	1.3	↓
-325	1.3	Tr	Tr	Tr	0.5	Tr	1.1	Tr	1.3	Tr
% Acceptor	56.3		61.5		64.1		66.8		68.9	
% Ash + SO_3 in Char	16.44		20.28		13.08		18.4		21.77	
Ash Elemental Analysis, Wt %										
SiO_2			44.29		44.07				43.65	
SO_3			6.85		7.50				5.32	
Na_2O			0.33		0.26				0.26	

(1)
(2) S-13B sample from the middle of the char bed
S-13C sample from the bottom of the char bed in the transition section

Table 40-12. GASIFIER CHAR BED MATERIAL FOR RUN 40B (Sheet 6 of 6)

Date	10/26/76	← 10/27/76 →			← 10/28/76 →		
Time	1915	0150	0945	1745	0210	1015	1505
Screen Size, Wt %							
Tyler Mesh							
+35	0.1	Tr	Tr	0	Tr	0	0
35 X 48	0.1	7.2	Tr	0.4	0.1	0.1	Tr
48 X 65	0.1	Tr	Tr	0.1	Tr	4.5	1.0
65 X 100	6.5	6.6	6.8	5.6	6.6	5.8	5.4
100 X 200	33.4	29.0	28.6	27.7	29.0	31.2	28.5
200 X 325	20.0	14.6	26.6	21.6	29.2	23.4	17.7
-325	39.8	42.5	37.9	44.5	35.0	35.1	47.3
Ultimate Analysis, Wt %							
C	62.61	55.12	51.53	51.36		54.71	55.33
H	0.91	0.99	0.80	0.75		0.78	0.91
N	0.24	-	0.28	0.28		-	0.27
Total S	0.77	0.92	0.84	0.77		0.61	0.69
Ash + SO_3	34.35	42.60	46.76	46.75		42.76	42.74
Elemental Analysis, Wt %							
SiO_2	44.90	49.35	53.65	50.86		49.10	45.87
SO_3	5.55	5.51	4.69	3.90		3.66	3.87
Na_2O	2.76	0.65	0.28	0.19		0.20	0.34
CaO	21.71	21.81	21.88	24.07		26.04	28.86
MgO	6.82	5.38	3.74	4.46		4.89	5.06
K_2O	0.44	0.22	0.14	0.10		0.12	0.20
Al_2O_3	9.92	10.11	7.88	8.04		7.48	8.77
Fe_2O_3	7.16	6.02	6.69	7.05		7.08	6.04
P_2O_5	0.05	0.03	0.03	0.03		0.03	0.03
TiO_2	0.62	0.63	0.65	0.68		0.86	0.78

Table 40-13. GASIFIER CHAR TO EXTERNAL CYCLONE FOR RUN 40A

Date	11/11/76		← 11/12/76 →			← 11/13/76 →			← 11/14/76 →			← 11/15/76 →		
Time	1030	1900	0400	1300	1715	0130	1430	1900	0210	1300	2000	0245	1230	1915
Screen Size, Wt %														
Tyler Mesh														
+35	Tr	0	0	1.8	Tr	0	↓	↓	Tr	Tr	0	1.1	0.5	1.3
35 X 48	Tr	0.2	0.1	0.5	0.6	1.3	Tr	↓	0.3	Tr	0	0.8	Tr	0
48 X 65	0.1	0.5	0.7	6.6	1.3	2.1	0.2	0.5	0.6	0.5	0.7	0.3	0.9	1.0
65 X 100	2.2	5.7	8.5	8.1	16.8	6.8	4.5	11.1	8.1	43.2	9.6	4.1	13.4	11.1
100 X 200	37.1	42.6	41.7	41.3	56.6	34.0	32.0	32.8	37.3	16.5	34.3	33.3	38.9	38.5
200 X 325	18.3	19.7	19.3	1.3	1.1	17.0	19.6	16.0	17.1	16.5	18.6	18.5	15.3	22.4
-325	42.3	31.4	29.7	40.3	23.6	38.7	43.7	39.5	36.6	30.9	36.9	41.9	31.0	25.7
Ultimate Analysis, Wt %														
C	62.31			58.62			56.87			57.33			61.33	
H	1.34			1.13			1.09			1.01			1.28	
N	0.47			-			-			-			0.39	
Total S	1.05			0.82			0.62			0.64			0.58	
Ash + SO_3	30.24			38.35			38.35			39.33			35.17	
Elemental Analysis, Wt %														
SiO_2	45.25			41.58			45.32			44.95			50.30	
SO_3	8.68			5.36			4.30			4.28			4.12	
Na_2O	3.03			2.49			0.63			0.50			0.25	
CaO	19.94			26.28			27.57			30.60			26.51	
MgO	6.03			6.01			5.02			4.86			4.99	
K_2O	0.53			0.40			0.31			0.18			0.14	
Al_2O_3	9.89			10.57			10.23			9.22			8.53	
Fe_2O_3	6.69			6.79			6.01			4.90			4.79	
P_2O_5	0.06			0.04			0.02			0.04			0.03	
TiO_2	0.40			0.50			0.15			0.55			0.48	

Table 40-14. GASIFIER CHAR TO EXTERNAL CYCLONE FOR RUN 40B (Sheet 1 of 2)

Date	← 11/16/76 →			← 11/17/76 →			← 11/18/76 →			← 11/19/76 →			11/20/76
Time	0230	1200	1900	0215	1000	1815	0145	0945	1830	0120	1000	1830	0300
Screen Size, Wt %													
Tyler Mesh													
+35	0.5	0.3	0	0	0.3	0.8	0.6	0.5	0.5	1.2	0	0.7	0
35 X 48	0.2	0.5	0	0.1	0.1	0.1	0.1	0	0.1	0.2	0	0.1	0.2
48 X 65	0.2	0.5	0.3	0.5	0.3	0.4	0.5	0.4	0.4	0.7	0.8	0.7	0.7
65 X 100	5.5	9.3	7.4	7.0	7.6	6.6	6.3	8.3	5.8	8.3	11.6	8.0	10.5
100 X 200	32.4	37.2	32.6	35.8	33.8	38.7	35.5	34.7	33.4	34.3	35.1	36.6	30.5
200 X 325	16.0	16.0	17.4	18.2	16.7	27.9	16.5	23.5	17.1	17.2	20.5	21.0	23.5
-325	45.3	36.7	42.3	38.4	41.3	25.6	42.5	32.5	42.7	38.0	32.0	32.9	28.6
Ultimate Analysis, Wt %													
C	58.39	60.79	57.82	57.05	52.64	57.04	58.41	56.59	51.90	59.26	59.81	52.13	60.02
H	0.93	0.82	0.88	0.84	0.87	0.94	0.93	0.73	0.96	0.96	0.94	0.97	0.89
N	-	-	-	-	-	-	-	-	-	-	-	-	-
Total S	0.65	0.49	0.60	0.59	0.55	0.53	0.53	0.64	0.48	0.59	0.53	0.54	0.60
Ash + SO_3	38.16	35.90	38.29	38.59	37.40	39.68	37.96	37.79	36.85	36.88	36.84	37.06	36.95
Elemental Analysis, Wt %													
SiO_2	46.67	47.84	45.87	43.07	43.73	44.46	43.20	42.51	46.38	45.18	44.80	44.48	40.39
SO_3	3.87	3.34	3.86	3.90	3.70	3.31	3.43	4.10	3.28	3.98	3.55	3.56	4.02
Na_2O		0.15	0.22		0.31	0.34	0.24	0.38	0.18	0.21	0.32	0.25	0.38
CaO		30.24	31.34		33.15	32.54	33.09	32.06	32.18	32.57	32.35	33.62	35.95
MgO		5.41	4.39		4.18	4.10	4.10	3.98	3.87	3.86	5.33	5.13	5.06
K_2O		0.10	0.13		0.16	0.20	0.14	0.23	0.06	0.08	0.17	0.11	0.18
Al_2O_3		7.59	8.71		9.32	9.56	9.68	10.71	8.49	8.81	8.79	8.77	9.00
Fe_2O_3		4.73	4.85		4.91	5.22	5.35	5.32	4.90	5.05	4.31	4.01	4.31
P_2O_5		0.02	0.02		0.03	0.03	0.03	0.04	0.02	0.02	0.02	0.02	0.02
TiO_2		0.42	0.45		0.51	0.47	0.43	0.56	0.46	0.30	0.40	0.15	0.70

Table 40-14. GASIFIER CHAR TO EXTERNAL CYCLONE FOR RUN 40B (Sheet 2 of 2)

Date	10/26/76	10/27/76	10/28/76
Screen Size, Wt %			
Tyler Mesh			
+35	0	3.3	0.4
35 X 48	1.8	18.0	16.7
48 X 65	9.5	15.6	17.2
65 X 100	13.4	10.8	13.8
100 X 200	39.0	20.0	28.8
200 X 325	32.4	28.9	22.1
-325	3.9	3.5	1.0
Ultimate Analysis, Wt %			
C	56.00	48.90	53.26
H	1.12	0.95	1.00
N	0.45	0.38	0.33
Total S	1.03	0.91	0.64
Ash + SO_3	43.21	44.18	42.95
Elemental Analysis, Wt %			
SiO_2	45.57	45.12	44.60
SO_3	4.67	5.26	3.86
Na_2O	0.45	0.12	0.61
CaO	24.09	23.82	26.20
MgO	2.84	2.88	3.57
K_2O	0.20	0.30	0.30
Al_2O_3	12.50	12.86	12.10
Fe_2O_3	8.35	7.56	7.64
P_2O_5	0.14	0.15	0.10
TiO_2	0.66	0.74	0.72

Table 40-15. GASIFIER QUENCH TOWER SOLIDS FOR RUN 40A

Date	11/12/76	11/13/76	11/14/76	11/15/76	11/16/76	11/17/76	11/18/76	11/19/76
Screen Size, Wt %								
Tyler Mesh								
+35	13.9	2.8	2.6	2.8	4.3	6.8	16.5	Tr
35 X 48	17.4	9.4	7.3	3.7	2.6	13.0	15.7	Tr
48 X 65	5.6	6.1	9.2	3.4	3.6	7.7	9.4	Tr
65 X 100	11.3	15.1	17.0	21.0	21.0	12.0	9.7	11.2
100 X 200	20.9	35.2	29.2	44.1	46.9	31.2	18.9	24.6
200 X 325	28.7	30.2	34.2	24.0	20.0	26.5	26.6	47.4
-325	2.2	1.1	0.5	0.9	1.6	2.8	3.1	16.8
Ultimate Analysis, Wt %								
C	52.20	56.42	57.13	57.78	54.77	55.56	57.26	58.05
H	1.00	0.84	1.03	1.17	1.20	1.11	1.26	1.36
N	0.37	-	-	0.38	-	-	0.37	-
Total S	1.14	1.08	0.68	0.81	0.68	0.69	0.67	0.67
Ash + SO_3	38.87	36.58	39.63	37.83	38.06	35.02	36.72	34.30
Elemental Analysis, Wt %								
SiO_2	38.26	45.38	38.26	40.14	38.11	39.51	40.97	41.15
SO_3	7.58	6.65	3.90	5.60	4.64	5.40	4.82	4.90
Na_2O	1.41	0.47	0.57	0.28	0.32	0.48	0.37	0.60
CaO	29.64	25.25	33.17	34.62	33.28	29.86	32.67	32.52
MgO	3.66	3.26	3.47	3.49	3.57	3.19	3.32	2.61
K_2O	0.30	0.16	0.17	0.23	0.16	0.30	0.18	0.25
Al_2O_3	11.46	10.76	11.49	9.06	12.01	13.72	11.26	11.41
Fe_2O_3	7.12	7.49	7.18	5.23	6.63	6.91	5.73	5.78
P_2O_5	0.10	0.10	0.08	0.12	0.12	0.32	0.11	0.10
TiO_2	0.52	0.62	0.61	0.55	0.63	0.70	0.73	0.74

Table 40-16. GASIFIER QUENCH TOWER SOLIDS FOR RUN 40B

Date	10/26/76		← 10/27/76 →						← 10/28/76 →			
Time	1530	2030	0000	0345	0800	1230	1800	2330	0325	1030	1315	1630
Screen Size, Wt %												
Tyler Mesh												
+6	↓	↓	↓	↓	0	↓	↓	↓	↓	0.4	↓	↓
6 X 8	0	0	0.4	0.3	5.5	6.6	5.2	27.8	19.1	19.2	13.5	8.2
8 X 9	↓	↓	↓	↓	7.9	↓	↓	↓	↓	20.0	↓	↓
9 X 10	0.8	3.1	4.6	3.1	16.7	18.9	12.7	29.0	25.2	17.9	31.8	28.8
10 X 12	↓	↓	↓	↓	31.5	↓	↓	↓	↓	18.6	↓	↓
12 X 14	69.9	69.7	73.1	74.9	22.3	52.4	61.2	32.5	37.5	12.5	35.0	38.8
14 X 16	↓	↓	↓	↓	11.4	↓	↓	↓	↓	6.2	↓	↓
16 X 20	27.6	25.2	20.3	19.1	2.9	18.8	16.9	10.2	12.9	2.4	13.4	14.9
20 X 24	↓	↓	↓	↓	0.7	↓	↓	↓	↓	0.8	↓	↓
24 X 28	1.2	1.3	1.2	1.6	0.3	1.8	1.8	1.6	2.2	0.5	3.0	3.5
-28	0.5	0.7	0.5	1.0	0.9	1.5	1.2	4.0	3.1	1.6	3.3	5.8
% Calcine Weight Change		0			+0.2	+0.5	-0.5			+0.8	+1.0	+0.9
Elemental Analysis, Wt %												
Sulfide												
SiO_2		3.51			7.96	8.01	8.07			10.56	11.05	10.38
SO_3		0.17			1.02	1.42	1.30			1.66	1.81	1.70
Na_2O		0.03			0.05	0.10	0.03			0.06	0.06	0.05
CaO		55.38			62.48	62.72	66.62			65.78	75.73	77.83
MgO		37.72			25.32	24.14	20.60			18.03	6.54	7.06
K_2O		0.01			0.01	0.01	0.01			0.01	0.02	0.01
Al_2O_3		1.08			1.53	1.63	1.37			1.98	1.79	1.62
Fe_2O_3		1.71			1.56	1.58	1.47			1.60	1.40	1.29
P_2O_5		0.01			0.02	0.02	0.02			0.02	0.03	0.03
TiO_2		0.09			0.11	0.15	0.11			0.11	0.11	0.11

Table 40-17. ACCEPTOR WITHDRAWAL FOR RUN 40A

Date	11/11/76	← 11/12/76 →			← 11/13/76 →			← 11/14/76 →			11/15/76		11/16/76	
Time	1340	2000	0120	0530	1045	0600	0830	1800	0510	0945	2215	0400	1600	0000	0805
Screen Size, Wt %															
Tyler Mesh															
+6	↓	↓	↓	↓	0	Tr	↓	↓	↓	0	↓	↓	0.1	↓	0.3
6 X 8	0	8.2	0.5	0.2	0.4	8.5	15.8	8.2	32.2	15.0	28.9	20.0	20.8	26.0	27.5
8 X 9	↓	↓	↓	0.9	1.0	12.7	16.1	↓	↓	18.4	↓	↓	22.4	↓	30.4
9 X 10	3.8	25.5	10.8	12.9	13.6	17.4	18.5	25.5	27.1	17.0	36.6	38.6	18.3	38.8	19.7
10 X 12	↓	↓	↓	39.3	36.9	25.3	22.2	↓	↓	19.0	↓	↓	13.4	↓	9.6
12 X 14	74.6	48.9	64.9	27.1	27.9	18.4	15.8	48.9	29.6	12.5	21.2	26.3	9.2	23.0	4.7
14 X 16	↓	↓	↓	14.6	15.0	9.3	7.2	↓	↓	7.4	↓	↓	5.7	↓	2.3
16 X 20	20.7	13.6	21.6	4.0	3.8	3.9	2.4	13.6	8.3	4.0	8.6	9.2	4.4	5.7	1.8
20 X 24	↓	↓	↓	0.7	1.0	1.5	0.9	↓	↓	2.0	↓	↓	2.4	↓	1.0
24 X 28	0.8	1.9	1.4	0.2	0.3	0.9	0.4	1.9	0.9	1.4	2.4	3.0	1.5	2.6	0.6
-28	0.2	1.9	0.8	0.2	0.6	2.0	0.6	1.9	2.0	3.3	2.2	3.0	2.0	3.8	2.1
% Calcine Weight Change				0.1			-0.3			0.6			-16.2		1.2
Elemental Analysis, Wt %															
SiO_2				3.93			7.58			8.10			8.86		7.32
SO_3				0.05			0.65			1.47			1.38		2.15
Na_2O				0.06			0.03			0.03			0.02		0.02
CaO				57.00			69.04			69.36			85.00		85.78
MgO				35.67			19.31			17.81			2.10		2.07
K_2O				0.01			0.01			0.02			0.01		0.02
Al_2O_3				1.16			1.62			1.67			1.58		1.57
Fe_2O_3				1.89			1.52			1.36			0.84		0.89
P_2O_5				0.02			0.02			0.03			0.02		0.03
TiO_2				0.08			0.10			0.07			0.09		0.08

Table 40-18. ACCEPTOR WITHDRAWAL FOR RUN 40B (Sheet 1 of 2)

Date	11/16/76		← 11/17/76 →				← 11/18/76 →				← 11/19/76 →			11/20/76	
Time	1430	1930	0100	0500	1040	1600	0045	0630	1200	1630	0030	1100	1530	0105	0800
Screen Size, Wt % Tyler Mesh															
+6	0.2	+	0.1	0.4	+	0.5	0.1	0.4	+	0.1	0.5	0.3	0.3	0.6	1.1
6 X 8	28.1	24.5	18.4	13.2	17.8	17.5	23.1	17.5	22.7	16.6	19.9	21.4	23.0	26.5	21.9
8 X 9	28.7	+	27.1	26.5	+	26.8	33.2	24.9	+	23.6	25.5	27.2	29.0	28.9	27.9
9 X 10	18.2	45.6	22.8	22.0	45.5	21.5	24.1	25.4	43.7	21.9	20.6	21.9	20.6	20.0	21.7
10 X 12	9.0	+	13.0	13.6	+	12.2	10.0	13.4	+	12.8	11.5	11.4	10.6	10.1	11.3
12 X 14	5.1	17.1	6.8	8.2	20.9	6.3	4.1	6.6	18.7	7.2	6.1	5.6	5.0	5.0	6.0
14 X 16	2.8	+	3.5	3.9	+	3.2	1.5	2.9	+	3.6	3.4	2.9	2.6	2.5	2.5
16 X 20	2.5	6.4	3.0	3.8	6.5	3.8	1.2	2.8	7.4	3.5	3.2	2.7	2.5	2.0	2.4
20 X 24	1.8	+	1.9	2.5	+	2.5	0.9	1.9	+	2.8	2.6	2.2	2.0	1.4	1.9
24 X 28	1.5	3.3	1.3	1.7	3.6	2.0	0.6	1.3	3.9	2.4	2.2	1.6	1.5	1.1	1.2
-28	2.3	3.1	2.0	4.3	5.8	3.7	1.5	2.9	3.7	5.5	4.5	2.8	2.8	1.9	2.2
% Calcine Weight Change	0.9		0.8	0.1		0.6	0.3	0.1		0.6	1.1	0.5	0.2	-0.7	0.8
Elemental Analysis, Wt %															
SiO_2	9.98		10.27	12.50		11.48	9.65	9.62		9.40	9.27	6.38	8.84	8.72	9.22
SO_3	2.35		2.32	2.06		1.40	1.78	2.03		2.42	2.15	1.71	1.46	1.77	1.84
Na_2O	0.05		0.03	0.04		0.04	0.02	0.02		0.02	0.05	0.02	0.03	0.03	0.03
CaO	81.54		82.76	80.29		82.74	85.33	85.28		85.21	83.94	87.71	85.00	85.43	85.91
MgO	2.13		2.04	2.05		1.61	1.08	1.18		1.16	1.71	1.75	1.06	2.02	1.06
K_2O	0.04		0.02	0.04		0.03	0.02	0.02		0.02	0.03	0.02	0.02	0.02	0.02
Al_2O_3	1.91		1.43	1.88		1.82	1.25	1.40		1.32	1.87	1.44	1.50	1.67	1.45
Fe_2O_3	0.99		0.96	1.01		0.95	0.76	0.72		0.79	1.00	0.68	1.02	0.76	0.83
P_2O_5	0.03		0.03	0.03		0.03	0.03	0.03		0.03	0.03	0.03	0.03	0.03	0.03
TiO_2	0.10		0.10	0.06		0.07	0.04	0.06		0.05	0.11	0.07	0.06	0.06	0.07

Table 40-18. ACCEPTOR WITHDRAWAL FOR RUN 40B (Sheet 2 of 2)

Date	← 10/27/76 →				← 10/28/76 →		
Time	0430	1130	1230	1800	0200	1015	1420
Hopper	B	A	B	B	B	B	A
Screen Size, Wt %							
Tyler Mesh							
+35	Tr	0	0.2	1.0	0.2	0.2	Tr
35 X 48	2.8	0.2	4.7	6.0	4.4	4.3	0.9
48 X 65	Tr	Tr	8.2	12.8	0.6	7.8	2.1
65 X 100	20.5	2.1	19.6	18.4	24.5	12.4	3.7
100 X 200	26.6	5.2	24.7	22.8	23.2	18.1	8.3
200 X 325	14.3	6.0	12.9	10.0	11.0	12.4	6.6
-325	35.7	86.3	29.7	29.1	36.3	44.9	78.3
Ultimate Analysis, Wt %							
Sulfide	-	-	-	-	-	-	-
C	4.54	7.53	6.98	8.55	8.15	10.59	7.16
H	0.21	0.30	0.20	0.22	0.17	0.11	0.21
N	0.04	0.03	0.06	0.03	0.05	0.07	0.05
Total S	2.37	2.01	1.78	1.86	1.99	2.85	3.26
Ash + SO_3	96.75	98.30	96.08	96.43	96.19	93.69	98.74
Elemental Analysis, Wt %							
SiO_2	36.07	24.55	35.06	36.15	33.53	30.71	25.38
SO_3	6.20	7.01	4.60	4.84	5.08	7.55	8.20
Na_2O	0.84	0.91	0.63	0.40	0.47	0.45	0.57
CaO	39.62	40.38	39.49	42.05	43.48	44.47	45.44
MgO	6.63	7.11	5.28	5.03	5.46	4.89	7.00
K_2O	0.28	0.27	0.22	0.13	0.15	0.18	0.24
Al_2O_3	4.50	10.76	9.64	7.09	7.44	7.52	8.14
Fe_2O_3	4.99	7.45	4.25	3.88	3.70	3.51	3.70
P_2O_5	0.04	0.05	0.07	0.05	0.17	0.03	0.02
TiO_2	0.50	0.71	0.62	0.56	0.50	0.54	0.67

Table 40-19. ASH AND ATTRITED ACCEPTOR FOR RUN 40A

Date	11/11/76		11/12/76	11/13/76	11/15/76	11/16/76	11/17/76	
Time	1730	1900	Composite	Composite	1830	1200	0515	1030
Hopper	B	A	B	B	B	B	B	A
Screen Size, Wt %								
Tyler Mesh								
+35	0.6	0.3	0.6	0.4	4.0	9.2	3.5	0.5
35 X 48	7.1	3.9	6.7	6.4	5.8	7.0	3.7	0.6
48 X 65	15.2	8.0	10.2	9.6	15.0	8.3	5.7	1.2
65 X 100	21.1	11.6	14.8	14.8	13.4	11.7	9.9	2.3
100 X 200	21.4	14.3	21.6	22.0	17.9	16.7	20.9	5.5
200 X 325	9.0	7.8	13.5	13.8	7.6	11.6	17.0	6.7
-325	25.6	54.2	32.6	33.0	36.4	35.4	39.3	83.3
Ultimate Analysis, Wt %								
C	23.14	19.60	7.68	7.99	8.56	7.05		6.32
H	0.24	0.38	0.28	0.46	0.25	0.10		0.38
N	0.11	0.17	0.07	0.04	-	0.03		0.05
Sulfide	0.24	0.39	0.63	1.24	1.41	1.61		2.48
Total S	1.26	1.22	1.25	2.51	3.25	2.64		3.70
Ash + SO_3	74.87	79.37	93.15	93.00	92.01	93.11		93.19
Elemental Analysis, Wt %								
SiO_2	41.31	32.93	37.50	30.74	30.64	32.67		20.87
SO_3	4.56	5.79	3.55	6.52	7.99	6.71		10.45
Na_2O	2.29	2.04	1.02	0.62	0.21	0.22		0.31
CaO	22.26	27.96	32.36	45.74	48.74	50.11		52.81
MgO	8.90	10.88	9.10	4.02	3.14	2.28		3.43
K_2O	0.57	0.55	0.35	0.23	0.09	0.08		0.25
Al_2O_3	9.93	10.53	9.07	7.83	6.48	4.74		7.88
Fe_2O_3	8.48	8.18	6.25	3.93	3.15	2.79		3.00
P_2O_5	0.06	0.07	0.07	0.05	0.04	0.04		0.04
TiO_2	0.59	0.58	0.62	0.56	0.27	0.77		1.00

Table 40-20. ASH AND ATTRITED ACCEPTOR FOR RUN 40B (Sheet 1 of 2)

Date	← 11/17/76 →			← 11 18/76 →			11/19/76	11/20/76
Time	1050	2000	Composite	1030	1645	1850	Composite	1120
Hopper	B	B	B	B	A	B	B	B
Screen Size, Wt %								
Tyler Mesh								
+35	0.8	8.5	4.2	5.2	0.6	4.8	5.0	1.9
35 X 48	1.8	6.9	4.1	4.9	0.4	4.8	4.8	4.7
48 X 65	4.5	8.4	6.2	6.9	0.7	6.5	6.7	6.9
65 X 100	8.9	11.7	10.2	10.8	1.5	9.8	10.3	10.8
100 X 200	17.0	16.2	18.0	17.4	4.5	17.4	17.4	18.4
200 X 325	12.4	12.4	13.9	15.5	6.6	13.9	14.7	17.0
-325	54.6	36.0	43.4	39.2	85.8	42.9	41.1	40.3
Ultimate Analysis, Wt %								
C			6.48	6.42		6.97	6.70	4.83
H			0.18	0.11		0.27	0.19	0.16
N			-	0.16		0.02	0.09	0.04
Sulfide			2.00	1.73		1.81	1.77	1.75
Total S			2.77	2.71		2.88	2.80	2.67
Ash + SO_3			93.43	93.33		92.88	93.10	95.11
Elemental Analysis, Wt %								
SiO_2			26.80	27.66		24.86	26.26	26.97
SO_3			6.95	7.05		8.03	8.29	7.52
Na_2O			0.25	0.22		0.15	0.18	0.24
CaO			52.72	52.78		51.84	52.31	51.59
MgO			2.79	2.31		2.66	2.48	2.49
K_2O			0.13	0.09		0.11	0.10	0.11
Al_2O_3			6.42	5.68		8.02	6.85	8.21
Fe_2O_3			2.71	2.77		2.76	2.77	2.61
P_2O_5			0.04	0.05		0.05	0.05	0.05
TiO_2			1.04	1.10		1.01	1.06	0.76

Table 40-20. ASH AND ATTRITED ACCEPTOR FOR RUN 40B (Sheet 2 of 2)

Date	← 11/16/76 →			← 11/17/76 →					← 11/18/76 →			← 11/19/76 →			11/20/76
Time	1100	1905	2300	0300	0700	1100	1500	1925	0300	1225	1704	0300	1400	1900	0300
Location*	Pressure, In. W.C.**														
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	70.6	73.1	79.8	82.0	76.7	76.7	76.6	76.3	66.7	76.9	77.8	71.8	53.5	94.3	78.6
3	209.9	207.9	211.6	213.9	209.0	213.1	217.6	217.1	210.7	216.4	218.8	198.1	190.2	229.2	215.2
4	279.6	277.3	279.0	282.3	277.9	282.2	287.2	285.7	280.5	285.4	287.3	261.7	258.1	293.3	280.5
5	287.7	276.0	277.8	281.0	279.8	284.1	279.9	281.4	279.3	293.3	289.2	278.4	287.3	286.0	291.6
6	270.0	257.9	260.2	264.8	264.1	269.7	265.5	266.7	265.4	275.1	268.6	264.5	277.1	272.8	280.4
7	233.1	221.3	222.2	227.7	227.4	230.3	229.8	230.7	226.5	239.1	231.8	227.3	235.3	232.5	236.1
8	198.8	186.8	187.7	193.5	193.2	195.7	195.1	195.7	190.4	203.7	197.1	191.3	198.5	197.3	201.0
9	5.0	2.8	1.9	22.9	22.7	13.4	9.2	7.9	15.9	8.1	7.6	6.3	9.3	38.1	29.1
10	-22.1	-21.3	-20.9	0.4	0.4	-10.4	-14.8	-16.6	-0.8	-31.2	-20.0	-17.9	-11.9	20.7	4.1
11	5.7	6.1	6.0	6.5	6.6	6.2	6.1	6.0	5.9	5.8	6.2	6.3	4.2	6.8	7.0
12	108.3	112.9	118.7	117.6	114.3	113.7	116.7	115.8	105.7	118.8	117.8	110.4	92.2	137.0	124.0
13	256.3	244.3	244.3	250.5	250.2	257.1	254.8	255.0	252.1	265.3	255.8	247.4	259.1	253.4	260.4
14	251.5	238.1	238.5	244.8	244.5	249.4	249.0	249.2	244.9	258.4	250.0	240.9	253.2	247.0	209.7
15	218.8	195.2	195.6	201.5	201.2	204.0	203.8	204.3	199.5	211.9	206.2	199.7	206.7	205.5	201.0

*Refer to Figure 1.
**Static pressure at Location 1 is 150 psig.
Pressures given are differential pressures from Location 1.

Table 40-21. PRESSURE BALANCE DATA FOR RUN 40B

Date		11/16/76 - 11/17/76	11/18/76
Time		1500 - 1130 Hours	0300 - 1500 Hours
		Temperatures, °F	
Gasifier			
Lignite Feed	TE-2215/16	316	280
Boot Heater Outlet	TE-2058	1500	1500
Boot Inlet Gas	TE-2040	1400	1400
Side Flow Heater Outlet	TE-2057	1480	1500
Regenerator			
Air Heater Outlet	TE-2047	800	800
Air Inlet to Regenerator	TE-2026	800	793
Acceptor Lift Gas Heater Outlet	TE-2050	1396	1400
Lift Gas Temperature at Engager Pot	TE-2013	1355	1353
Char Lift Gas Heater Outlet	TE-2054	800	800
Char Lift Station Gas Temperature	TE-2041	768	770
Char Disengager Pot Temperature	TE-2028	495	505

Table 40-22. BALANCE PERIOD AVERAGE PREHEATS FOR RUN 40B

RUN 41

RUN 41A DECEMBER 10 TO DECEMBER 17, 1976

RUN 41B DECEMBER 22 TO DECEMBER 29, 1976

CO_2 ACCEPTOR PROCESS GASIFICATION

PILOT PLANT

RAPID CITY, SOUTH DAKOTA

1 SUMMARY

Run 41 was comprised of two runs, Runs 41A and 41B. These runs were attempts to achieve the primary objectives of (1) testing the ruggedness of the newly installed refractory-lined acceptor lift line, and (2) demonstrating technical feasibility for the CO_2 Acceptor Process using Wyodak subbituminous coal as feedstock and Minnekahta limestone as acceptor. The second objective was not accomplished due to premature run shutdowns for both runs. However, the first objective was achieved. During both Runs 41A and 41B, the new line performed perfectly. Inspection of the line after each run revealed it to be in excellent condition.

2 TEST DATA

Run 41 data are presented graphically and/or tabularly at the end of this run report. These figures and tables include:

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3 SIGNIFICANT EVENTS AND OBSERVATIONS

3.1 TABULAR HISTORY OF RUNS 41A AND 41B

3.1.1 Objectives

The goals of both segments of Run 41 were:

(1) To test the new refractory lined acceptor lift line.

(2) To demonstrate technical feasibility of the process using a subbituminous coal feedstock.

(3) To test coal as the auxiliary fuel feed to the regenerator.

3.1.2 Accomplishments

(1) The new acceptor lift line proved satisfactory. There was no major deterioration of the refractory liner.

(2) Raw Wyodak subbituminous coal was fed to the regenerator as auxiliary fuel for the first time during Run 41A. Subbituminous coal was again used in Run 41B. The switch to the coal did not cause any regenerator slag or deposit formations, nor were there any operating problems associated with its use.

3.1.3 Termination Causes

Run 41A

Solids transfer out of the gasifier boot was lost and could not be regained. The loss of circulation was due to the blockage of the recarbonated acceptor standleg by a chunk of agglomerated dead-burned dolomite deposit.

Run 41B

Shortly after all recycle gas flow to the gasifier boot was replaced with steam, the control of the char-acceptor interface became unstable. During attempts to stabilize the interface, a gasifier boot upset occurred which led to the termination of the run.

3.1.4 Mechanical Problems

There were no major mechanical problems with the plant.

3.1.5 Major Changes Made Prior to Run 41

(1) Replaced the existing acceptor lift line with a new refractory lined lift line.

(2) Extensively modified the boot gas distributor and acceptor withdrawal. The flat plate distributor and side withdrawal were replaced with a ring distributor and center withdrawal.

3.1.6 Process Problems

The gasifier boot instability which occurred during Run 41B was the only process problem experienced. The cause of this instability is being investigated and may be related to either stickiness of acceptor due to the high steam partial pressure in the boot or to the low density of the acceptor particles.

3.2 CHRONOLOGY OF OPERATIONS

3.2.1 Run 41A

Date	Time	Hours Run	Description
12/10	1620	-126.2	Started pressuring up the system.
"	1900		Started the static pressure test.
12/11	0310	-115.3	Finished the static pressure test.
"	0610		Started the recycle gas compressors. Lit all process heaters.
"	1330		Started the refractory cure holding period at 250°F.
12/13	0130	-69.0	Finished the refractory cure holding period.
12/14	0110		Started filling the gasifier with dead-burned dolomite via F-204A, fresh lignite feed lockhopper.
"	0625		Began feeding dead-burned dolomite to the regenerator via F-206, fresh acceptor feed lockhopper.
"	1550	-30.7	Started the solids circulation tests.
"	1810		Started the gas circulation tests.
"	1930		Started the gasifier boot distributor flow tests.
"	2210		Started steam to the gasifier side flow.
12/15	0010	-22.3	Began filling the gasifier with char via F-204A.
"	0650		Introduced air to the gasifier side flow.
"	1120		Started steam to the gasifier boot.
"	1930	-3.0	Established char transfer to the regenerator.

Date	Time	Hours Run	Description
12/15	2107		Began feeding auxiliary fuel to the regenerator.
"	2230	0	Regenerator at 1800°F.
12/16	0520	6.8	Began feeding Wyodak subbituminous coal to the gasifier via F-204A.
"	0810	9.7	Filled F-206, fresh acceptor lockhopper, with 6 X 8 limestone.
"	0835		Initiated CO_2 flow to the gasifier boot.
"	1120		Began air-steam-recycle gas flow changes to the gasifier.
"	2115	22.8	Experienced gasifier boot upset.
"	2200		Recovered from upset.
12/17	0435	30.1	Experienced another upset in the gasifier boot. Unable to transfer solids out of LCV-2003. Stopped overhead transfer and lignite makeup.
"	1230	38.0	Unable to regain transfer through LCV-2003. Initiated shutdown procedures.
12/18	0330		System depressured.

3.2.2 Run 41B

12/22	1310	-83.8	Pressured up the system.
"	1800		Started the static pressure test.
"	1830	-78.5	Finished the static pressure test.
12/23	0100		Started all recycle gas compressors.
"	0300		Lit all process gas heaters.
"	0700		Started the refractory cure holding period at 250°F.
"	0808	-64.9	Depressured due to a plug in the char lift line, CO-204.
"	1000		Pressured up the system.
"	1115	-61.8	Started all the recycle gas compressors.
"	1145		Lit all process gas heaters.
"	1400		Started the 250°F refractory cure holding period.
"	1700		Finished the refractory cure holding period.
12/24	1600	-33.0	Started filling the gasifier with dead-burned dolomite via F-204A, the lignite feed lockhopper.
"	2125		Started feeding dead-burned dolomite to the regenerator via F-206, fresh acceptor lockhopper.
12/25	0405		Started circulating dead-burned dolomite.
"	0510	-19.8	Started the solids circulation tests.
"	0700		Started the lift line gas flow tests.
"	0840		Started the gasifier boot distributor fluidization tests.

Date	Time	Hours Run	Description
12/25	1053		Initiated steam flow to the gasifier side.
"	1145		Started feeding char to the gasifier via F-204A.
"	1520		Initiated air flow to the gasifier side.
"	1820		Initiated steam flow to the gasifier boot.
"	2030		Established char transfer.
"	2325		Initiated auxiliary char feed to the regenerator.
12/26	0100	0.0	Regenerator at 1800°F.
"	0600		Began feeding Wyodak subbituminous coal to the gasifier via F-204A.
"	1235	11.6	Filled F-206 with fresh 6 X 8 limestone
"	1355		Started the air-steam-recycle gas changes to the gasifier.
12/27	1200	35.0	All air flow out of the gasifier side.
12/28	0145		FI-2075 plugged causing a surge of char to the regenerator.
"	1330	60.5	All recycle gas out of the gasifier boot.
"	1650-1920		Gasifier interface control is erratic. Shifted steam flow from the side to the boot in an attempt to straighten out the boot.
"	2325		Plant pressure balance swung and the gasifier interface control deteriorated.
"	2327	70.5	Blew the gasifier interface.
12/29	0120		Unable to reestablish the gasifier interface, initiated plant shutdown procedures.
"	1100	82.0	System depressured.

4 RESULTS AND DISCUSSION

4.1 BACKGROUND

The original acceptor lift line which conveys recarbonated acceptor from the gasifier to the regenerator was constructed with a high-alloy process-containing liner which was surrounded by insulation. The liner and insulation were then contained in a carbon steel pressure shell. This was a rugged design which was expected to withstand, better than a refractory design, the many heatups and cooldowns anticipated in the pilot plant operation. Recycle regenerator flue gases were used to convey recarbonated acceptor through the lift line. When these gases are reducing and contain no oxygen, combustion in the lift line of any char that might accompany the recarbonated acceptor cannot take place. With the metal liner design, combustion was to be avoided in order to prevent line failures such as occurred during Run 3 when a char acceptor mixture was transferred to the regenerator.

During the past years of operation, the metal lift line has performed well. However, commercial CO_2 Acceptor Process designs require the use of air and not recycle gas to convey recarbonated acceptor. For this application, a refractory lift line design is required because of possible high temperatures should char and acceptor be transferred together during plant upsets. In anticipation of demonstrating the use of air lift, a refractory lift line was designed and installed prior to Run 41. The primary purpose of the run was to determine if there were any major mechanical problems with the lift line design. Because the line could be heated to the normal operating temperatures of 1200° to $1500^{\circ}F$ with recycle gas, a conservative approach was taken and no air was admitted to the line during the run.

Run 41 also afforded an opportunity to demonstrate technical feasibility of the CO_2 Acceptor Process using Wyodak subbituminous coal as feedstock and Minnekahta limestone as acceptor. During Run 38 heat and material balances were obtained for this combination of feedstock and acceptor. However, air had to be injected into the gasifier during the balance periods. The acceptor tended to hold up in the gasifier char bed because the acceptor particle density was low. The acceptor holdup increased the char bed density. Sufficient acceptor circulation to maintain the char bed temperature could not then be achieved.

Low equilibrium acceptor particle density appears to be associated with the use of Wyodak coal as feedstock. To improve the chances of obtaining stable operating periods without the need for gasifier air injection, the acceptor makeup was increased from the normal 560 pounds per hour to 840 pounds per hour, and a new boot gas distributor was

Installed. The higher acceptor makeup rate was expected to improve purging of intermediate fines which made their way into the regenerator and to provide a higher equilibrium acceptor activity which would lessen the actual pounds of acceptor circulation required. The new boot distributor was designed to minimize dead spots in the boot and to provide better gas distribution. If the char-acceptor interface could thereby be further stabilized, perhaps acceptor showering would also be improved.

4.2 ACCOMPLISHMENTS

The hours of plant operation for Runs 41A and 41B are summarized below:

	Run 41A	Run 41B
Hours of gasification without air flow to the gasifier	0	35.5
Hours of gasification without recycle flow to the gasifier	0	10
Hours at system pressure	153.5	133
Hours at process temperatures	30	70.5
Hours with Wyodak subbituminous feed	23	65.5
Hours with active Minnekahta limestone feed	20	59
Hours of acceptor circulation	61	91.5

Although air was removed as a source of gasifier heat during Run 41B, neither run was sufficiently long to allow changeout of the original dead-burned dolomite inventory and to establish truly steady-state operating conditions. The runs did demonstrate the operability of the new acceptor lift line.

4.3 PLANT DATA

The pertinent data for Runs 41A and 41B are presented in Tables 41-1 through 41-19. Operating conditions are shown in Tables 41-1 through 41-4. The feedstock composite analyses are presented in Table 41-5. Effluent and process solids analyses are shown in Tables 41-6 through 41-18. The pressure balance data and calculated pressure balances are presented for Run 41B in Table 41-19. Figure 41-1 is a schematic which shows the locations of the Table 41-19 pressure balance points.

4.4 PROCESS MODIFICATIONS

4.4.1 Acceptor Lift Line

One of the primary objectives of Run 41 was the testing of the new refractory lined acceptor lift line which was installed prior to Run 41A. The previous line had a metal liner of Incoloy 800 material with ceramic cones in the transition of the internal slip joints. This earlier lift line was described in the Run 33 report. The new line was built in six sections rather than like the original line which had only two sections. Six sections were used to facilitate fabrication, installation, inspection, and repair.

The new refractory lift line took over 2 years to design while various materials and design concepts were reviewed. The material for the liner (the 4-inch-ID pipe which contains the flowing acceptor and lift gas) must resist erosion and withstand thermal shock, and ideally, the liner material would also be an insulating material. No materials of construction were found to possess both the required physical strength and low thermal conductivity. Therefore, a two-component system was designed as shown in Figure 41-2.

Two designs were considered. The line cores for both designs use 1-foot cylinders made from a special electric furnace mullite/alumina composition. The material is Mullfrax-202, which was supplied by the Carborundum Company. In one design the insulating component between the core and the carbon steel shell was bubble alumina castable. This material offered the best physical strength for supporting the Mullfrax core. The Mullfrax was high compression strength but very low tensile strength. The bubble alumina would hold the Mullfrax in compression at all times so that pressure surges or rapid cooldowns would not damage the liner. This design was rugged; however, it required increasing the overall diameter of the line from 10 inches to 18 inches to insure that the carbon steel shell would not overheat. Installation of the line would have required major revisions in the pilot plant structure.

A design which required the same size steel shell as the existing 10-inch line was formulated. The insulating material is a ceramic fiber known as Fiberfrax. A 1-inch layer of vacuum-cast Fiberfrax between the Mullfrax liner and steel shell provides sufficient insulation. The Mullfrax cylinders which are 2 inches thick are supported at the bottom of each spool section by a steel plate (donut) which is insulated by a Fiberfrax gasket. This first Mullfrax core has a longer male portion than normal so that it mates flush with the top of the preceding section. There is no gap between sections and each section is flush with the flange of the steel shell.

At the top of each spool section, a special spacer piece is sized to fill the remaining pipe, since each of the six sections is a different length. The last piece has a long male portion and is flush with the top flange. These last two pieces are sized to give a preset gap which will close up as the liner is heated during startup. At 1200°F all gaps are closed. All gaps close up before acceptor is added to the system. During fabrication some of the end pieces had to be cut to fit.

The line showed no appreciable wear after Runs 41A and 41B. The only damages noted were cracks in core sections which had been drilled to provide pressure tap access. Presently, the line is in excellent condition.

4.4.2 Boot Gas Distributor

The data report which covers Runs 22 and 23 contains the description of a plenum chamber with bubble caps design for a gasifier boot gas distributor. This type of distributor (shown in Figure 41-3) was used for all runs starting with Run 22B and ending with Run 40B. The design provided much better gas distribution than earlier designs which were tried. However, the plenum design with acceptor withdrawal at the vessel wall had one bad feature. The acceptor flow near the bottom of the boot was skewed to one side. As shown in Figure 41-3, a nonfluidized area often formed which funneled the recarbonated acceptor into the standleg. Given enough time, acceptor or dead-burned dolomite particles in the nonfluidized area would agglomerate. Although the boot deposit formed a natural geometry, which did not noticeably affect the operation of the gasifier, the deposit presented a potential danger of breaking apart and plugging the acceptor standleg.

So, to further improve gas distribution and to minimize the dead areas which led to deposit formation, the ring distributor design, which is also shown in Figure 41-3, was installed prior to Run 41A. Details of this design are shown in Figure 41-4. The main feature of the design is the removal of acceptor from the center of the gasifier boot. This insures that all material which enters the gasifier boot is transferred out. During Run 41A the new distributor appeared to work well. Inspection of the boot after the run revealed very little deposit. Deposits of dead-burned dolomite formed only between the ring and the wall and in a dead area just below the ring (see Figure 41-3).

4.5 DEPOSITS

The regenerator and gasifier vessels were both inspected after each run. The condition of the regenerator was essentially the same for each inspection. Only minor amounts of agglomerated dead-burned dolomite were found in the dead area between the side flow gas distributor ring and the wall of the reactor. These deposits were typical and did not in any way affect the operation of the reactor.

After Run 41A the gasifier contained a small amount of agglomerated dead-burned dolomite around and below the new boot gas distributor. A portion of the deposit from below the distributor became detached during the run and blocked the entrance to the recarbonated acceptor standleg. To prevent such occurrences in future runs, the dead area below the ring was filled in with refractory to form a cone-shaped transition leading into the standleg.

The gasifier boot deposit was more extensive after Run 41B. Again, deposits formed between the distributor ring and the wall all the way around the circumference of the boot. The deposits extended for approximately 35 inches up above the bottom head flange. The maximum thickness was 2 inches with the deposits tapering to the wall at the top. The deposit formed a steep cone which funneled acceptor into the center of the distributor ring and on into the inlet of the recarbonated acceptor standleg. This deposit strongly adhered to the wall of the reactor. The bottom 5 inches of the deposit was agglomerated dead-burned dolomite. The upper 30 inches was a mixture of dead-burned dolomite and active acceptor. The surface of the deposit was composed of what appeared to be a 1/2-inch-thick layer of agglomerated fines. The total mass of this deposit was approximately the same as that for typical deposits which formed above the old plenum chamber gas distributor. However, the location and shape of the new deposits presented less disruption to the acceptor flow and gas distribution in the boot than the earlier deposits. The cause of the deposits appears to be the dead area between the ring distributor and the boot wall. Although one-half of the distributor's gas jets are directed toward the boot wall to help fluidize this area, solids pack into the gas between the distributor and the wall. Most of the gas flow is then through the remaining jets which are pointed toward the center of the boot. The packed-in material then acts as a ledge on which acceptor collects and eventually agglomerates. If the deposit reached an equilibrium thickness during Run 41B, then its presence can be considered innocuous.

The vessel inspections following both runs revealed massive deposits of agglomerated acceptor deposits in the transition section of the gasifier. These deposits were artifacts of the attempts to recover the acceptor circulation following the upsets which eventually terminated the runs. When acceptor transfer from the boot ceased, the acceptor which was contained in the char bed continued to shower and collected in the transition section. Here the acceptor defluidized and eventually agglomerated.

5 FUTURE PLANS

Before commencing Run 42, the regenerator internal diameter will be reduced from 33 inches to 24 inches. This will be accomplished by laying brick on top of the existing cast refractory. The diameter reduction will allow sufficient gas velocity to strip the char ash from the calcined acceptor when air is used as the only fluidizing gas to the regenerator. Run 42 will demonstrate the use of air for acceptor lift gas.

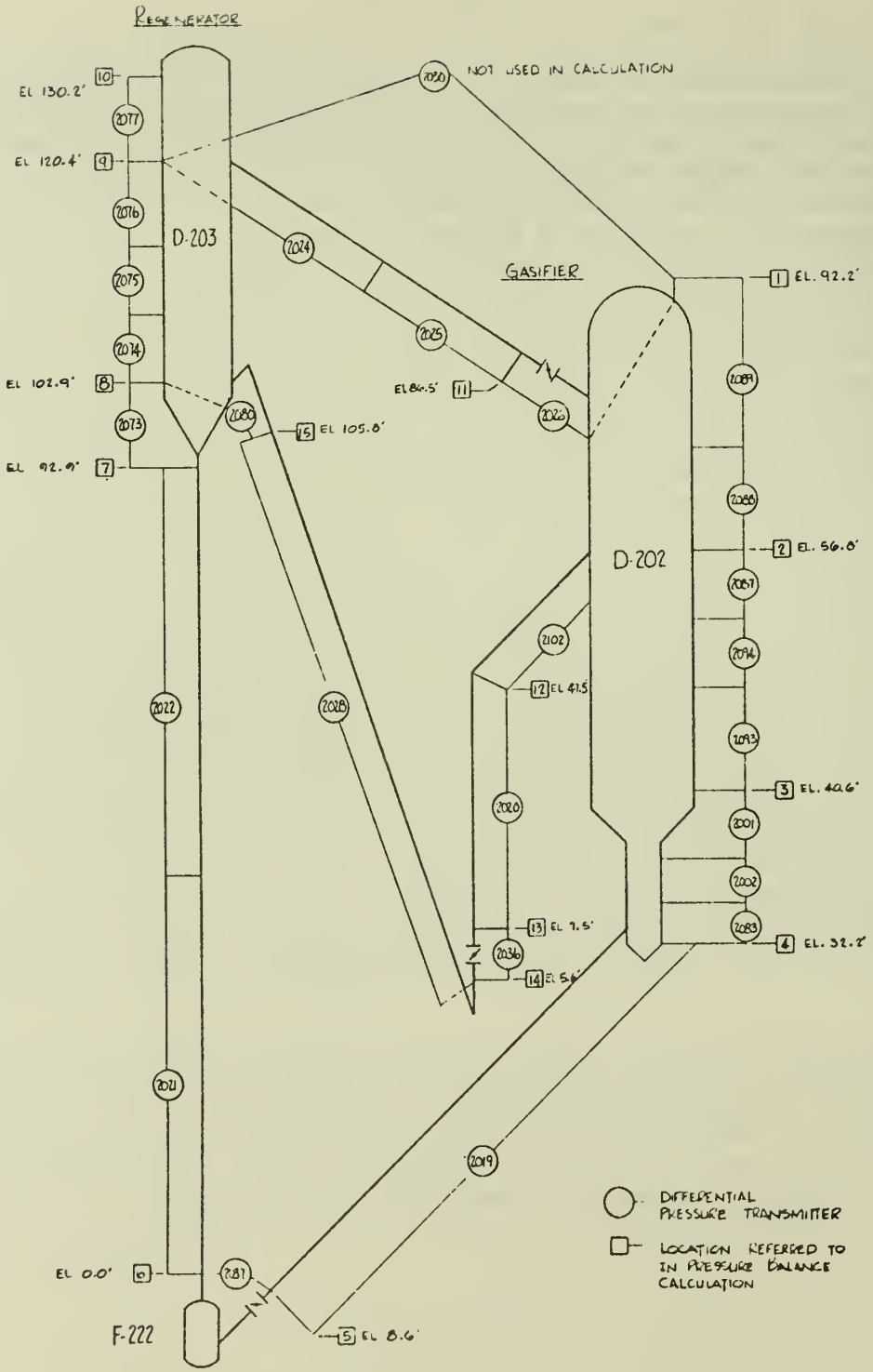


Figure 41-1. DIFFERENTIAL PRESSURE TRANSMITTER LOCATION FOR PRESSURE BALANCE CALCULATION

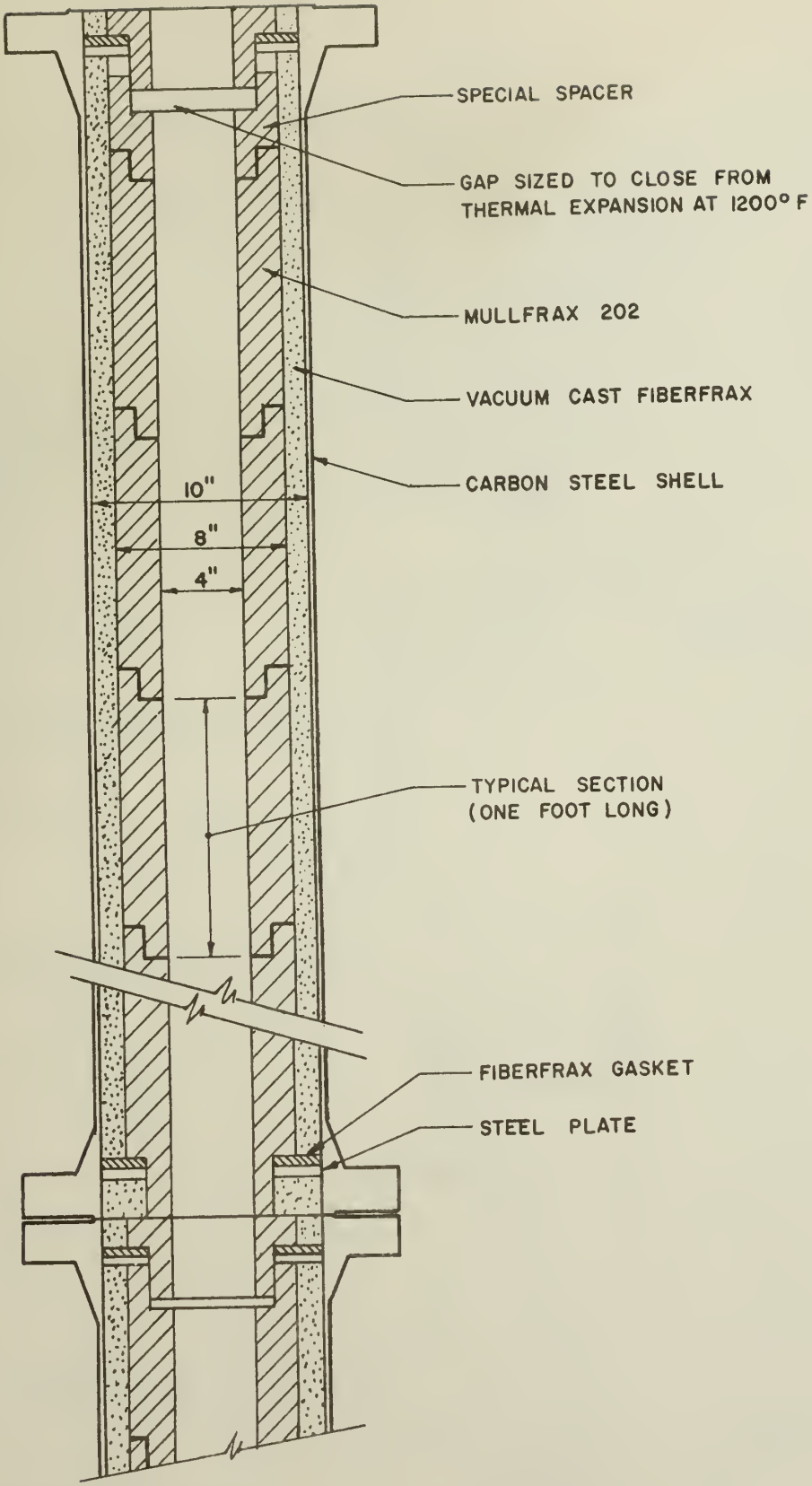


Figure 41-2. LIFT LINE CONSTRUCTION

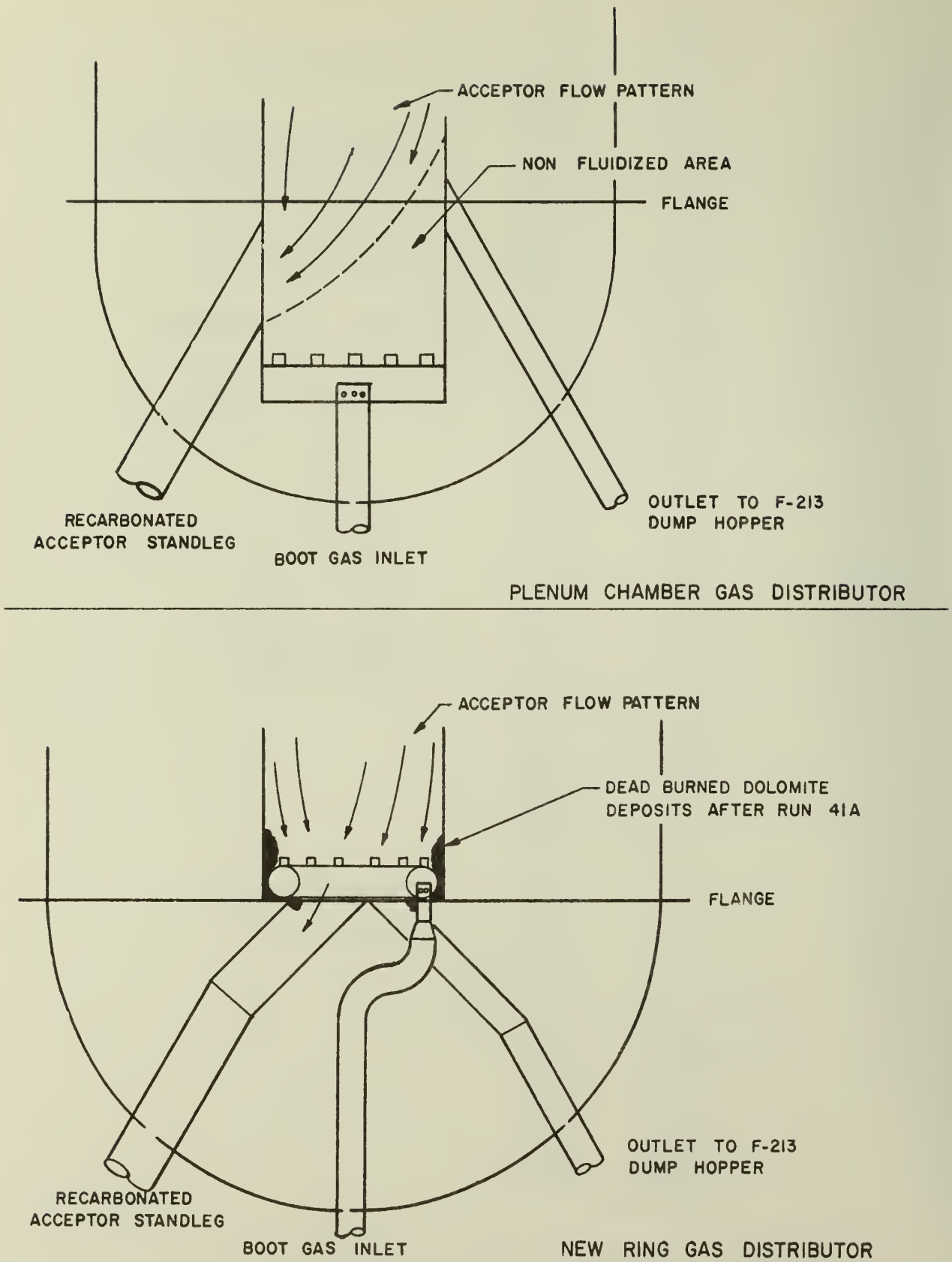
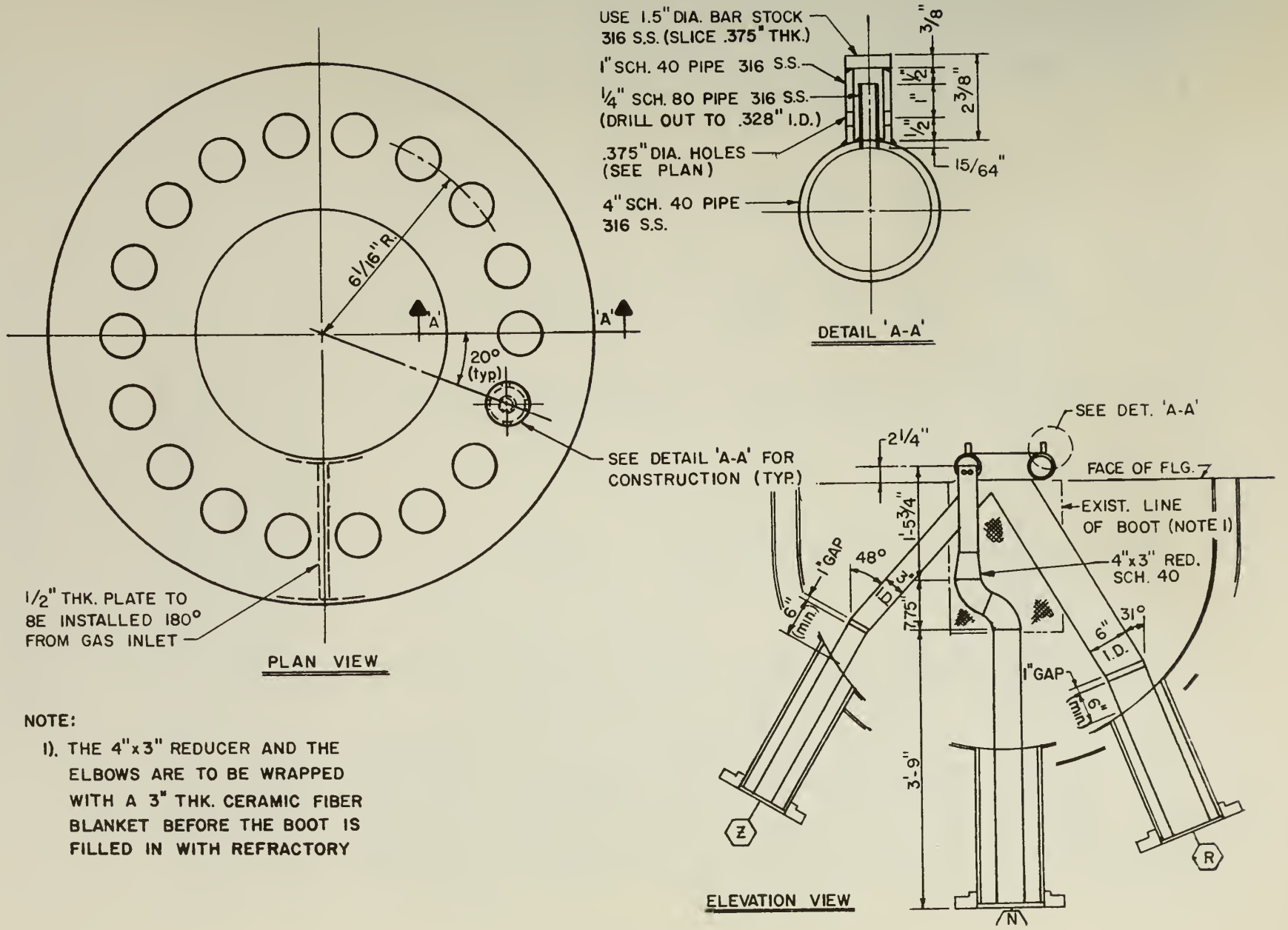


Figure 41-3. BOOT DISTRIBUTORS



NOTE:

1). THE 4"x3" REDUCER AND THE ELBOWS ARE TO BE WRAPPED WITH A 3" THK. CERAMIC FIBER BLANKET BEFORE THE BOOT IS FILLED IN WITH REFRACTORY

Figure 41-4. GASIFIER BOOT RING DISTRIBUTOR DESIGN

Date	12/15/76	← 12/16/76 →		
Time	1900	0400	1100	2300
Solids				
Feedstock	Husky Char		Wyodak Subbituminous	
Feed Rate, lb/hr[1]	1,575	1,360	1,960	2,160
Recovered Overhead Solids, lb/hr	-	180	220	265
Solids to Organic Pond, lb/hr	25	45	75	65
Gas Flows[2]				
Boot (Recycle), MSCFH	17.2	16.8	15.9	10.8
Boot (Steam), MSCFH	18.8	18.6	19.2	27.0
Boot (CO_2), MSCFH	0.0	0.0	1.1	1.0
Side (Steam), MSCFH	29.8	29.7	29.7	21.9
Side (Air), MSCFH	19.5	19.7	19.1	9.2
Purge (Recycle), MSCFH	2.0	2.1	2.2	2.3
Purge (Inert), MSCFH	2.1	2.1	2.6	2.4
Total Inlet, MSCFH	89.4	89.0	89.8	74.6
Vent Rate, MSCFH	47.0	56.4	72.2	59.9
Bed Conditions				
Boot Velocity, ft/sec[3]	1.9	2.0	2.0	2.1
Bed Velocity, ft/sec[3]	0.9	0.9	0.9	0.8
Boot Density, lb/cu ft[4]	101	98	96	84
Bed Density, lb/cu ft[4]	38	40	36	34
Bed Height, ft[4]	26.4	25.4	25.0	25.8
Average Boot Temperature, °F	1405	1485	1515	1530
Average Bed Temperature, °F	1325	1480	1500	1515
Overhead Gas Compositions				
CO, Mol %[5]	8.3	15.1	15.3	13.6
CO_2, Mol %[5]	19.9	17.9	15.6	15.0
N_2, Mol %[5]	42.8	31.8	27.3	19.9
H_2, Mol %[5]	26.4	31.7	34.2	42.1
CH_4, Mol %[5]	2.6	3.5	7.6	9.4

[1] Determined by feeder RPM: char, lb/hr = 420 X RPM; subbituminous coal, 392 X RPM.
[2] Determined by orifice flow meter measurements.
[3] Based on inlet gas flow rates.
[4] Determined by pressure tap measurements.
[5] Determined by gas chromatographic measurements.

Table 41-1. GASIFIER DATA, RUN 41A

Date	12/15/76	← 12/16/76 →		
Time	1900	0300	1100	2300
Solids	Dead-Burned Dolomite		Minnekahta Limestone	
Acceptor Feedstock				
Acceptor Makeup, lb/hr[1]	360	360	840	840
Auxiliary Char Fuel, lb/hr[1]	0	55	25	40
Acceptor Circulation, lb/hr[2]	5,300	7,000	10,000	11,000
Reject Acceptor, lb/hr[3]	155	150	570	550
Ash and Attrited Acceptor, lb/hr[3]	-	140	150	160
Gas Flows[4]				
Acceptor Lift (Recycle), MSCFH	58.2	54.8	54.5	54.3
Char Lift, MSCFH	10.1	10.1	10.1	10.2
Ring (Air), MSCFH	57.0	59.1	74.3	84.5
Ring (Recycle), MSCFH	65.5	57.8	20.6	5.1
Purge (Recycle), MSCFH	1.5	1.4	1.2	1.9
Purge (Nitrogen), MSCFH	2.6	1.9	2.2	1.6
Total Inlet, MSCFH	194.9	175.1	163.1	157.6
Vent Rate, MSCFH	74.9	76.0	100.5	118.6
Bed Conditions				
Gas Velocity Inlet, ft/sec	2.4	3.2	3.0	2.8
Bed Density, lb/cu ft[5]	101	99	91	83
Bed Height, ft[5]	20.2	20.1	18.9	19.4
Average Bed Temperature, ^{o}F	1095	1840	1840	1815
Overhead Gas Compositions				
O_2, Dry Mol %[6]	0.0	0.0	0.0	0.0
CO, Dry Mol %[6]	0.0	2.6	2.5	3.4
CO_2, Dry Mol %[6]	0.4	15.7	22.6	21.2
N_2, Dry Mol %[6]	99.6	81.5	74.6	75.6

(1) Determined by feeder RPM: dead-burned dolomite, 360 X RPM; limestone, 280 X RPM; auxiliary fuel, 368 X RPM.
(2) Determined by lift line pressure drop measurements.
(3) Determined by weigh scale measurements.
(4) Determined by orifice flow meter measurements.
(5) Determined by pressure tap readings.
(6) Determined by gas chromatograph or on-line analyses measurements.

Table 41-2. REGENERATOR DATA, RUN 41A

Date	12/26/76		← 12/27/76 →			← 12/28/76 →		
Time	1100	1900	0300	1200	1900	0300	1100	1900
Solids								
Feedstock	← Wyodak Subbituminous →							
Feed Rate, lb/hr[1]	1,960	1,960	2,120	2,000	2,080	2,040	2,200	2,120
Recovered Overhead Solids, lb/hr	155	135	135	115	165	115	90	145
Solids to Organic Pond, lb/hr	50	45	40	30	35	25	25	20
Gas Flows[2]								
Boot (Recycle), MSCFH	19.4	14.1	10.6	7.6	7.5	7.8	5.4	4.2
Boot (Steam), MSCFH	16.3	23.0	29.9	30.0	30.3	29.3	30.0	36.6
Boot (CO_2), MSCFH	0.0	1.0	1.1	1.0	1.0	1.0	1.1	1.1
Side (Steam), MSCFH	26.6	26.6	18.5	17.8	18.1	18.2	17.7	15.3
Side (Air), MSCFH	16.9	13.4	5.5	1.5	0.0	0.0	0.0	0.0
Purge (Recycle), MSCFH	2.2	2.3	2.5	2.6	2.3	2.3	2.6	2.4
Purge (Inert), MSCFH	2.7	2.7	2.7	2.7	2.3	2.5	2.6	1.5
Total Inlet, MSCFH	84.1	83.1	70.8	63.2	61.5	61.1	59.4	61.1
Vent Rate, MSCFH	52.3	58.4	44.5	36.7	42.8	43.3	43.8	46.5
Bed Conditions								
Boot Velocity, ft/sec[3]	2.0	2.2	2.2	2.1	2.0	2.0	1.9	2.0
Bed Velocity, ft/sec[3]	0.9	0.9	0.7	0.6	0.6	0.6	0.6	0.6
Boot Density, lb/cu ft[4]	96	92	84	78	74	71	65	62
Bed Density, lb/cu ft[4]	37	35	37	39	38	39	38	40
Bed Height, ft[4]	25.0	24.2	26.4	27.2	25.2	26.0	25.6	25.2
Average Boot Temperature, °F	1495	1530	1525	1520	1515	1515	1495	1505
Average Bed Temperature, °F	1485	1525	1530	1525	1525	1525	1510	1520
Overhead Gas Compositions								
CO, Mol %[5]	15.9	15.9	14.5	12.4	14.1	13.7	12.7	13.0
CO_2, Mol %[5]	16.0	13.5	12.3	8.6	7.9	6.5	7.0	7.4
N_2, Mol %[5]	29.4	22.7	16.0	9.8	9.5	9.6	9.4	9.9
H_2, Mol %[5]	31.4	40.0	46.6	55.8	56.6	56.7	56.7	56.7
CH_4, Mol %[5]	7.3	7.9	10.6	13.4	12.8	13.5	14.2	13.0

(1) Determined by feeder RPM: subbituminous coal, 392 X RPM.
(2) Determined by orifice flow meter measurements.
(3) Based on inlet gas flows.
(4) Determined from pressure tap measurements.
(5) Determined by gas chromatographic measurements.

Table 41-3. GASIFIER DATA, RUN 41B

Date	12/26/76	← 12/27/76 →			← 12/28/76 →		
Time	1100	1900	0300	1200	1900	0300	1100	1900
Solids								
Acceptor Feedstock	Dead-Burned Dolomite	← Minnekahta Limestone →						
Acceptor Makeup, lb/hr[1]	360	840	840	840	840	840	840	840
Auxiliary Char Fuel, lb/hr[1]	190	405	295	50	315	240	200	300
Acceptor Circulation, lb/hr[2]	9,300	9,800	10,100	11,600	11,000	11,200	9,800	9,300
Reject Acceptor, lb/hr[3]	815	620	505	355	585	570	660	505
Ash and Attrited Acceptor, lb/hr[3]	100	125	140	175	155	160	150	155
Gas Flows[4]								
Acceptor Lift (Recycle), MSCFH	55.8	55.2	54.9	54.9	55.0	54.9	55.1	55.2
Char Lift, MSCFH	9.7	9.8	9.7	9.7	9.8	9.7	9.8	9.9
Ring (Air), MSCFH	63.8	80.6	88.8	90.2	91.2	90.6	89.1	92.3
Ring (Recycle), MSCFH	23.0	15.5	15.5	0.0	0.0	0.0	0.0	0.0
Purge (Recycle), MSCFH	3.0	2.8	2.7	2.7	2.7	2.7	2.5	2.5
Purge (Nitrogen), MSCFH	2.5	2.1	2.1	2.4	2.3	2.1	2.0	2.3
Total Inlet, MSCFH	157.8	166.0	173.7	159.9	161.0	160.0	158.5	162.3
Vent Rate, MSCFH	78.5	99.4	111.8	116.8	122.5	123.4	118.5	120.8
Bed Conditions								
Gas Velocity Inlet, ft/sec	2.9	3.0	3.1	2.9	2.9	2.9	2.9	3.0
Bed Density, lb/cu ft[5]	92	89	83	73	71	72	67	62
Bed Height, ft[5]	19.2	19.1	18.9	18.3	19.4	19.7	19.2	18.9
Average Bed Temperature, °F	1860	1840	1835	1835	1840	1840	1840	1835
Overhead Gas Compositions								
O_2, Dry Mol %[6]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO, Dry Mol %[6]	4.1	1.9	1.9	2.7	3.1	1.3	4.2	3.4
CO_2, Dry Mol %[6]	17.1	23.7	25.4	25.5	26.0	25.3	24.4	25.0
N_2, Dry Mol %[6]	78.5	74.1	72.7	71.6	70.6	73.3	71.1	71.4

[1] Determined by feeder RPM: dead-burned dolomite, 360 X RPM; limestone, 280 X RPM; auxiliary fuel, 368 X RPM.
[2] Determined by lift line pressure drop.
[3] Determined by weigh scale measurements.
[4] Determined by orifice flow meter measurements.
[5] Determined by pressure tap readings.
[6] Determined by gas chromatograph measurements.

Table 41-4. REGENERATOR DATA, RUN 41B

Date 12/25/76 - 12/28/76

Screen Size, Wt % Tyler Mesh	Acceptor Minnekahta Limestone	Screen Size, Wt % Tyler Mesh	Wyodak Subbituminous 12/26	12/27	12/28
+4	0.0	+8	0.0	0.0	0.0
4 X 8	44.7	8 X 20	10.6	12.8	12.7
8 X 10	44.6	20 X 48	58.3	60.3	58.0
10 X 14	9.7	48 X 100	22.1	20.3	21.5
14 X 20	0.2	-100	9.0	6.6	7.8
20 X 28	0.1				
-28	0.7				
Calcine Weight Loss, %	42.8				
Ultimate Analysis, Wt %					
Moisture			0.4	0.2	0.6
C			67.9	67.9	67.7
H + Moisture H			4.3	4.4	4.8
N			0.8	0.8	0.8
S			0.81	0.69	0.71
Ash + SO_3			10.14	8.37	7.96
Elemental Analysis, Wt %					
SiO_2	2.30		37.48	37.33	34.91
SO_3	0.05		13.51	11.94	12.38
Na_2O	0.03		1.38	1.37	1.28
CaO	95.76		23.10	23.39	25.70
MgO	0.91		5.68	5.65	6.19
K_2O	0.09		0.40	0.33	0.38
P_2O_5	0.04		0.45	0.74	0.65
Al_2O_3	1.13		10.96	12.96	13.59
Fe_2O_3	0.35		5.67	4.95	5.76
TiO_2	Tr		0.58	0.74	0.76

Table 41-5. FEEDSTOCK COMPOSITES, RUN 41B

Date	12/15/76		← 12/16/76 →		
Time	0800	1600	0000	0800	1915
Screen Size, Wt % Retained on Tyler Mesh					
4	0.0			0.0	
6	Tr			0.0	
8	0.3	0.6	0.3	0.4	5.5
9	1.2			0.9	
10	12.5	14.4	8.1	19.2	24.6
12	45.6			48.2	
14	25.5	76.8	77.5	23.4	59.0
16	11.2			7.1	
20	3.2	7.8	13.2	0.7	9.4
24	0.3			0.1	
28	0.1	0.2	0.3	Tr	0.3
Pan	0.1	0.2	0.6	Tr	1.2

Table 41-6. CIRCULATING ACCEPTOR, CALCINED ACCEPTOR TO GASIFIER, RUN 41A

Date	← 12/26/76 →			← 12/27/76 →			← 12/28/76 →		
Time	0800	1550	2325	0800	1650	2340	0800	1540	2010
Screen Size, Wt % Retained on Tyler Mesh									
4	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
6	0.0	0.0	0.0	Tr	Tr		0.1	0.1	0.1
8	0.5	0.4	7.8	14.3	17.7	22.7	25.7	23.6	24.0
9	1.2	1.5	9.2	14.3	17.3		25.4	25.0	25.9
10	14.5	11.0	19.6	21.2	19.1	35.7	20.9	21.4	21.0
12	54.2	49.2	34.1	29.9	20.7		15.5	15.5	13.5
14	10.9	25.7	19.5	13.9	13.0	34.7	6.9	8.0	7.5
16	12.6	8.7	7.6	4.5	5.3		1.9	2.3	2.3
20	3.4	2.3	1.4	1.0	1.7	5.1	1.0	1.4	1.3
24	0.6	0.3	0.3	0.3	0.8		0.6	0.8	0.9
28	0.3	0.1	Tr	Tr	0.6	1.0	0.4	0.5	0.7
Pan	1.8	0.8	0.5	0.6	3.8	0.8	1.6	1.4	2.8
Particle Density, lb/cu ft	198	186	170	160	138		125	120	112
Calcine Weight Change, %	-0.2	-0.2	-0.1	-0.2	-0.3		-0.7	-1.4	-0.9
Elemental Analysis, Wt %									
S=	0.05	0.06	0.04	0.06	0.02		0.02	0.02	0.04
SiO_2	2.35	3.64	4.33	3.90	4.00		4.24	5.97	5.42
SO_3	0.16	0.09	0.10	0.05	0.09		0.09	0.04	0.20
Na_2O	0.04	0.09	0.05	0.04	0.03		0.04	0.17	0.02

Table 41-7. CIRCULATING ACCEPTOR, CALCINED ACCEPTOR TO GASIFIER, RUN 41B

Date	12/15/76	← 12/16/76 →				
Time	1600	0400	0800	1200	1600	2000
Screen Size, Wt % Retained on Tyler Mesh						
4			0.0			
6			0.0			
8	0.4	0.1	Tr	0.1	1.8	5.7
9			0.5			
10	1.0	4.5	11.3	13.2	19.1	19.9
12			37.3			
14	74.4	72.8	27.1	65.2	57.5	55.8
16			16.3			
20	21.7	20.4	4.9	18.9	17.5	15.2
24			1.1			
28	1.6	1.4	0.5	1.3	1.7	1.8
Pan	0.9	0.8	1.0	1.3	2.4	1.6
Particle Density, lb/cu ft				198		180
Activity				0.01		0.07

Table 41-8. CIRCULATING ACCEPTOR, RECARBONATED ACCEPTOR FROM GASIFIER, RUN 41A

Date	← 12/26/76 →		← 12/27/76 →			← 12/28/76 →		
Time	0800	1600	0000	0800	1200	1330	1600	2000
Screen Size, Wt % Retained on Tyler Mesh								
4	0.0	0.0	0.0	0.0		0.0	0.0	
6	Tr	0.0	0.0	0.1		0.1	0.1	
8	0.1	2.0	3.6	6.8	9.2	20.6	18.7	22.1
9	0.5	3.4	6.5	9.4		20.8	19.6	
10	9.8	13.8	13.6	16.0	18.3	22.0	19.5	30.1
12	36.2	36.9	32.6	27.9		16.7	16.4	
14	27.6	25.4	23.4	19.9	54.2	10.1	10.4	31.9
16	16.9	13.1	12.9	9.7		3.7	4.1	
20	5.3	3.8	4.3	4.7	13.0	2.2	3.1	5.6
24	1.3	0.9	1.2	1.5		1.6	2.4	
28	0.8	0.1	0.5	1.2	1.2	1.1	2.1	1.0
Pan	1.5	0.6	1.4	2.8	4.1	1.1	3.6	9.3
Particle Density, lb/cu ft	199	186	180	182	178	145	133	136
Calcine Weight Change, %	-1.0	-2.4	-4.7	-11.0			-7.8	
Activity				0.04	0.01	0.10	0.09	0.09
Elemental Analysis, Wt %								
S=	0.13	0.03	0.07	0.05			0.07	
SiO_2	1.85	2.42	3.89	4.05			6.24	
SO_3	0.07	0.13	0.08	0.16			0.30	
Na_2O	0.08	0.22	0.08	0.06			0.05	
CaO	57.54	59.29	62.71	80.67			85.86	
MgO	36.74	34.60	30.10	12.16			3.98	
K_2O	0.01	0.02	0.01	0.03			0.03	
Al_2O_3	1.31	1.43	1.60	1.54			2.00	
Fe_2O_3	1.30	1.40	1.27	0.97			0.90	
P_2O_5	0.01	0.02	0.04	0.08			0.12	
TiO_2	0.14	0.18	0.11	0.10			0.11	

Table 41-9. CIRCULATING ACCEPTOR, RECARBONATED ACCEPTOR FROM GASIFIER, RUN 41B

Date	← 12/16/76 →						12/17/76	
Time	1200		1600		2000		0020	
Sample Portion	Total	Acceptor	Total	Acceptor	Total	Acceptor	Total	Acceptor
Screen Size, Wt % Retained on Tyler Mesh								
8	0.0		0.9		0.6		2.1	
9		3.3		4.5		9.1		16.0
10	0.4		1.9		47.6		4.7	
12		38.3		37.6		33.1		39.6
14	23.0	18.3	22.5	14.8	8.4	13.6	26.3	13.2
20	10.9	15.0	8.8	15.9	4.2	15.2	7.7	12.3
28	6.7	3.3	4.6	4.5	3.5	4.8	3.1	2.8
35	16.4		14.9		9.6		11.7	
48	17.6		17.9		11.0		14.4	
65	11.6	21.7	12.4	21.6	6.7	24.2	11.0	16.0
80		0.1		1.1		0.0		0.1
100	8.8		9.7		5.4		9.4	
200	4.4		5.5		2.7		6.7	
325	0.0		0.5		0.2		1.2	
Pan	0.2	Tr	0.4	0.0	0.1	0.0	1.7	Tr
Acceptor, Wt %	42.4		42.8		38.8		50.5	
Ash + SO_3 in Char, Wt %	19.9		18.9		20.0		20.3	

Table 41-10. GASIFIER CHAR BED MATERIAL, RUN 41A

Date	← 12/26/76 →										12/27/76	
Time	0800		1200		1600		1800		2000		0000	
Location	Bed		Bed		Bed		Transition		Bed		Bed	
Sample Portion	Total	Acc.	Total	Acc.	Total	Acc.	Total	Acc.	Total	Acc.	Total	Acc.
Screen Size, Wt % Retained on Tyler Mesh												
8	0.0		0.1		0.1		1.0		0.7		1.6	
9		1.1		0.9		2.9		5.1		8.9		16.9
10	1.1		0.8		1.9		3.6		2.5		4.6	
12		39.5		42.4		46.2		40.9		45.5		40.6
14	31.4	19.8	26.1	19.8	24.9	19.2	27.4	16.8	24.1	17.0	26.7	15.3
20	13.2	20.9	12.2	20.7	11.2	17.3	11.0	18.2	10.6	13.4	11.5	11.9
28	5.5	3.3	6.0	2.7	4.3	1.9	2.9	4.4	3.8	3.6	6.2	3.4
35	13.0		17.0		14.7		17.8		17.4		16.3	
48	14.6		16.5		16.5		15.6		16.2		14.9	
65	8.9	14.3	10.5	13.5	11.2	12.5	9.8	14.6	10.6	11.6	8.3	11.9
80		1.1		0.0		0.0		0.0		0.0		0.0
100	6.7		6.7		8.2		6.6		7.4		5.4	
200	4.5		3.6		5.0		3.4		4.4		3.0	
325	0.7		0.3		0.9		0.3		0.9		0.5	
Pan	0.4	Tr	0.2	0.0	1.1	0.0	0.6	0.0	1.4	0.0	1.0	0.0
Acceptor, Wt %	49.2		45.9		46.8		50.0		48.7		48.9	
Ash + SO_3 in Char, Wt %	21.5		18.0		19.1		17.5		15.7		14.4	
Ash Elemental Analysis, Wt %												
SiO_2	36.48				38.88						37.63	
SO_3	6.32				1.10						0.88	
Na_2O	3.33				2.90						2.28	

Table 41-11. GASIFIER CHAR BED MATERIAL, RUN 41B (Sheet 1 of 3)

Date	← 12/27/76 →								← 12/28/76 →			
Time	0400		0800		1200		1600		1800		2000	
Location	Bed		Bed		Bed		Bed		Transition		Bed	
Sample Portion	Total	Acc.	Total	Acc.	Total	Acc.	Total	Acc.	Total	Acc.	Total	Acc.
Screen Size, Wt % Retained on Tyler Mesh												
8	3.6		3.3		4.0		6.0		6.3		4.9	
9		21.4		14.5		21.3		23.7		33.7		23.1
10	8.9		5.2		10.6		14.1		11.5		11.4	
12		36.9		43.5		41.0		39.8		34.8		38.5
14	23.5	13.1	29.4	13.7	25.7	12.6	24.5	11.9	27.0	10.0	25.1	8.5
20	10.5	13.1	8.7	12.9	7.3	11.0	7.6	9.3	7.7	6.3	6.8	6.0
28	4.8	3.6	1.7	4.0	2.2	3.1	2.8	3.4	2.6	4.7	3.3	
35	17.7		15.1		14.3		13.2		15.1		14.1	
48	14.8		14.4		14.9		12.6		13.5		13.7	
65	8.2	11.9	10.8	11.3	10.1	11.0	8.5	11.9	8.3	10.5	9.2	12.8
80		0.0		0.1		0.0		0.0		0.0		0.0
100	5.2		7.0		7.1		6.2		5.5		6.5	
200	2.3		3.3		2.9		3.3		2.2		3.4	
325	Tr		0.5		0.3		0.5		0.1		0.6	
Pan	0.5	0.0	0.6	0.0	0.6	0.0	0.7	0.0	0.2	0.0	1.0	0.0
Acceptor, Wt %	51.7		55.1		53.6		57.5		60.9		57.9	
Ash + SO_3 in Char, Wt %	13.3		12.9		15.5		14.3		8.8		9.1	
Ash Elemental Analysis, Wt %												
SiO_2			37.35				38.61					
SO_3			1.22				1.23					
Na_2O			2.56				3.30					

Table 41-11. GASIFIER CHAR BED MATERIAL, RUN 41B (Sheet 2 of 3)

Date	← 12/28/76 →													
Time	0000		0400		0800		1200		1600		1800		2000	
Location	Bed		Bed		Bed		Bed		Bed		Transition		Bed	
Sample Portion	Total	Acc.	Total	Acc.	Total	Acc.	Total	Acc.	Total	Acc.	Total	Acc.	Total	Acc.
Screen Size, Wt % Retained on Tyler Mesh														
8	6.5		8.2		7.7		7.4		8.0		9.4		10.3	
9		28.1		32.5		32.4		31.8		36.9		43.7		40.4
10	11.8		11.9		15.8		13.8		16.1		19.6		16.0	
12		32.7		36.4		33.3		29.5		29.8		27.7		28.9
14	26.3	10.2	29.1	7.8	19.8	9.3	18.5	6.8	21.8	7.9	22.3	5.6	22.4	5.3
20	6.3	9.4	6.1	7.1	5.1	6.5	5.0	8.0	4.8	6.1	4.9	5.6	4.7	6.1
28	2.7	6.3	2.4	6.5	3.6	7.4	3.4	5.7	1.3	5.3	1.9	5.1	2.8	6.1
35	15.7		13.9		13.0		15.9		15.2		14.6		12.6	
48	13.2		12.3		13.6		15.4		12.8		11.7		12.1	
65	8.2	13.3	7.5	9.7	9.1	11.1	9.7	18.2	8.5	14.0	7.2	12.3	7.6	13.2
80		0.0		0.0		0.0		0.0		0.0		0.0		0.0
100	5.5		5.3		7.1		6.9		6.4		5.0		6.1	
200	2.8		2.6		3.9		3.2		3.6		2.6		3.5	
325	0.4		0.3		0.6		0.4		0.6		0.4		0.6	
Pan	0.6	0.0	0.4	0.0	0.7	0.0	0.4	0.0	0.9	0.0	0.4	0.0	1.3	0.0
Acceptor, Wt %	56.7		63.5		54.2		47.4		56.6		64.3		62.9	
Ash + SO_3 in Char, Wt %	9.2		11.7		13.2		16.5		16.3		15.9		11.5	
Ash Elemental Analysis, Wt %														
SiO_2	45.09								33.37				39.55	
SO_3	2.25								3.86				3.73	
Na_2O	2.89								1.14				1.15	

Table 41-11. GASIFIER CHAR BED MATERIAL, RUN 41B (Sheet 3 of 3)

Date	12/15/76	← 12/16/76 →			
Time	1930	0215	0840	1315	1900
Screen Size, Wt % Retained on Tyler Mesh					
4			0.0		
6			0.0		
8	0.1	0.1	Tr	0.4	1.1
9			0.5		
10	11.4	2.1	11.1	8.9	13.8
12			40.3		
14	68.6	65.2	28.4	58.7	67.4
16			15.0		
20	18.6	28.1	4.0	25.6	16.4
24			0.5		
28	0.9	2.3	Tr	2.7	0.7
Pan	0.4	2.2	0.2	3.7	0.6

Table 41-12. REJECT ACCEPTOR WITHDRAWAL, RUN 41A

Date	← 12/26/76 →			← 12/27/76 →				← 12/28/76 →			
Time	1030	1535	2105	0400	0900	1600	2000	0140	1100	1230	2040
Screen Size, Wt % Retained on Tyler Mesh											
4	0.0	0.0			0.0	0.0			0.0	0.0	
6	0.0	Tr			0.0	Tr			0.0	Tr	
8	Tr	0.3	1.2	11.4	2.5	4.2	14.8	16.8	10.6	18.5	21.8
9	0.3	0.8			6.9	7.7			17.9	20.5	
10	9.1	9.0	6.6	22.0	17.8	19.4	29.0	25.2	27.2	23.8	31.8
12	31.9	38.7			36.2	31.2			23.0	19.7	
14	40.1	28.9	69.2	50.2	22.4	22.3	44.8	47.1	13.3	10.9	37.0
16	13.2	15.6			9.3	10.0			4.2	3.6	
20	3.8	5.1	20.6	13.6	3.3	2.9	9.4	8.1	1.6	1.3	5.2
24	0.7	0.9			0.7	0.9			0.8	0.7	
28	0.3	0.2	1.0	1.1	0.3	0.5	0.3	0.7	0.5	0.3	2.3
Pan	0.6	0.5	1.4	1.7	0.6	0.9	1.7	2.1	0.9	0.7	1.9
Particle Density, lb/cu ft		188				152				136	
Calcine Weight Change, %		-0.01				-0.04				-0.02	
Elemental Analysis, Wt %											
S=		0.03				0.04				0.03	
SiO_2		3.02				3.75				4.17	
SO_3		0.08				0.02				0.12	
Na_2O		0.10				0.03				0.03	
CaO		58.71				65.14				85.39	
MgO		34.82				27.88				7.58	
K_2O		0.01				0.01				0.01	
Al_2O_3		1.21				1.42				1.65	
Fe_2O_3		1.25				1.18				1.00	
P_2O_5		0.02				0.04				0.10	
TiO_2		0.12				0.12				0.06	

Table 41-13. REJECT ACCEPTOR WITHDRAWAL, RUN 41B

Date	← 12/16/76 →			12/17/76
Time	0715	1730	1845	0050
Hopper	B	B	A	B
Screen Size, Wt % Tyler Mesh				
+35	1.5	0.9	0.6	1.0
35 X 48	6.1	3.1	0.6	3.3
48 X 65	10.5	6.2	1.1	7.3
65 X 100	13.8	9.5	2.0	13.8
100 X 200	19.1	16.9	4.6	24.1
200 X 325	15.5	14.0	5.6	14.4
-325	33.5	49.3	85.6	36.1

Table 41-14. ASH AND ATTRITED ACCEPTOR, RUN 41A

Date	12/26/76		12/27/76		← 12/28/76 →			
Time	0305	1800	0330	1720	0335	1100	1100	1635
Hopper	B	B	B	B	B	A	B	B
Screen Size, Wt %								
Tyler Mesh								
+35	1.2	0.7	1.9	2.2	2.5	0.9	2.2	1.7
35 X 48	3.5	2.9	6.7	4.7	4.3	0.3	5.3	4.6
48 X 65	7.6	5.6	9.6	7.4	7.7	0.9	8.7	8.1
65 X 100	10.3	9.3	13.7	11.6	11.8	1.6	14.2	13.3
100 X 200	19.1	18.0	22.4	19.6	22.2	4.1	23.0	22.0
200 X 325	14.8	14.7	15.6	14.0	14.9	4.7	14.8	15.1
-325	43.5	48.8	30.1	40.5	36.6	87.5	31.8	35.2
Calcine Weight Change, %	-3.4	-9.1	-6.6	-13.3	-9.7	-12.6	-10.2	-10.8
Ultimate Analysis, Wt %								
C	2.06	9.60	5.37	13.72	12.51	13.69	10.31	10.02
H	0.17	0.41	0.38	0.16	0.11	0.19	0.17	0.30
N	Tr	Tr	-	0.05	0.05	0.04	-	Tr
Sulfide	0.14	0.43	0.15	0.52	0.80	1.35	0.44	0.65
S	0.72	0.72	0.29	0.99	0.98	1.44	1.27	1.73
Ash + SO_3	96.6	90.9	93.4	86.7	90.3	87.4	89.8	89.2
Elemental Analysis, Wt %								
SiO_2	40.68	35.48	33.63	34.04	35.09	29.65	36.43	33.36
SO_3	2.26	2.83	0.72	2.15	2.62	6.00	3.49	4.77
Na_2O	2.54	2.45	6.68	1.81	1.11	1.04	1.03	5.44
CaO	26.32	36.17	44.86	45.89	45.63	46.70	44.03	42.70
MgO	9.78	8.17	4.06	3.50	4.00	3.29	2.97	3.04
K_2O	0.44	0.38	0.42	0.45	0.47	0.51	0.40	0.37
Al_2O_3	10.03	9.72	7.17	7.49	8.18	9.79	8.02	7.69
Fe_2O_3	7.20	3.64	2.00	2.06	2.06	2.29	1.97	1.96
P_2O_5	0.10	0.17	0.28	0.31	0.39	0.41	0.30	0.27
TiO_2	0.38	0.39	0.41	0.40	0.38	0.40	0.37	0.37

Table 41-15. ASH AND ATTRITED ACCEPTOR, RUN 41B

Date	← 12/16/76 →				12/17/76	
Time	0400	0910	1430	2000	0020	0100
Screen Size, Wt % Tyler Mesh						
+35	2.1	2.1	1.5	0.4	Tr	0.7
35 X 48	0.5	Tr	0.6	0.1	0.3	0.3
48 X 65	0.6	Tr	2.6	1.6	1.1	1.6
65 X 100	2.4	6.4	13.7	8.1	7.3	9.5
100 X 200	33.3	37.8	39.7	36.6	36.2	36.9
200 X 325	36.1	36.7	31.8	22.5	28.7	19.6
-325	25.0	17.0	10.2	30.7	26.4	31.4

Table 41-16. GASIFIER CHAR TO EXTERNAL CYCLONE, RUN 41A

Date	← 12/26/76 →			← 12/27/76 →			← 12/28/76 →		
Time	0540	1215	2000	0140	1045	1900	0240	1045	1845
Screen Size, Wt %									
Tyler Mesh									
+35	0.4	0.7	0.7	2.7	0.6	1.2	0.1	0.3	6.5
35 X 48	0.1	0.2	0.4	0.8	0.1	0.4	0.1	0.1	25.6
48 X 65	0.5	0.7	3.3	2.7	1.6	1.4	0.7	0.7	8.0
65 X 100	3.1	4.0	15.7	9.8	11.3	8.5	30.1	5.9	14.4
100 X 200	24.9	36.1	34.1	32.1	41.5	34.4	21.1	33.5	16.0
200 X 325	47.9	26.1	20.8	29.7	16.5	17.0	11.5	16.3	14.2
-325	23.8	32.2	25.0	22.2	28.4	37.1	36.4	43.2	15.3
Ultimate Analysis, Wt %									
C		62.40	63.68		71.18		64.13	64.62	
H		0.67	0.90		1.07		1.07	0.76	
N		0.28	0.30		0.33		0.31	0.30	
S		0.74	0.24		0.25		0.45	0.36	
Ash + SO_3		31.84	29.32		25.25		29.58	24.02	
Elemental Analysis, Wt %									
SiO_2		37.30	34.18		35.95		33.33	34.52	
SO_3		5.29	1.22		2.36		3.35	3.25	
Na_2O		0.64	0.82		2.75		2.10	0.88	
CaO		24.98	32.06		37.88		36.95	38.14	
MgO		8.60	9.28		4.12		4.22	4.82	
K_2O		0.40	0.40		0.37		0.39	0.36	
Al_2O_3		13.00	13.05		11.11		11.91	11.98	
Fe_2O_3		9.24	7.43		4.63		5.01	4.84	
P_2O_5		0.08	0.06		0.17		0.54	0.52	
TiO_2		0.55	0.67		0.54		0.62	0.71	

Table 41-17. GASIFIER CHAR TO EXTERNAL CYCLONE, RUN 41B

Date	12/26/76	12/27/76
Screen Size, Wt %		
Tyler Mesh		
+35	3.1	3.6
35 X 48	7.6	3.0
48 X 65	11.3	3.6
65 X 100	10.7	4.2
100 X 200	19.9	18.5
200 X 325	34.6	55.2
-325	12.8	11.9
Ultimate Analysis, Wt %		
C	60.81	67.43
H	1.31	1.03
N	0.31	0.32
S	0.79	0.75
Ash + SO_3	31.16	24.51
Elemental Analysis, Wt %		
SiO_2	35.88	33.50
SO_3	6.37	7.28
Na_2O	1.78	2.06
CaO	31.59	33.04
MgO	3.64	3.11
K_2O	0.25	0.43
Al_2O_3	12.59	14.09
Fe_2O_3	7.05	5.84
P_2O_5	0.12	0.18
TiO_2	0.59	0.69

Table 41-18. GASIFIER QUENCH TOWER SOLIDS COMPOSITES, RUN 41B

Date				← 12/26/76 →			← 12/27/76 →				← 12/28/76 →			
Time				1000	1305	1810	0255	0820	1600	1930	0320	1115	1515	1830
DPR-*	Chart	Zero	Range In. W.C.	← Instrument Readings →										
2030	-10/10	9.0	554.0	6.9	6.8	6.8	6.4	5.0	5.9	4.0	3.4	2.7	1.2	1.2
2089	0/100	4.2	25.0	7	19	7	48	25	13	29	68	20	40	15
2088	0/100	3.0	168.7	32.5	33.5	28	31.5	34	33	36	37	35	37	38
2087	0/100	3.0	43.7	72	71	63	68	70	69	73	75	71	76	81
2094	0/100	3.0	53.9	68	70	61	66	69	69	71	74	70	74	77
2093	0/100	3.0	115.4	38.5	38.5	34.5	37	37.5	37	38	39	37.5	39.5	40
2001	0/100	3.0	126.2	20	20	17	19	19	20	21	22	21	22	23.5
2002	0/100	3.0	57.1	40.5	40.5	40.5	40.5	38	37.5	37.5	38	34.5	33.5	32.5
2083	0/100	3.0	57.7	64	63	62	56	54	51	49	47	44	41	40
2019	0/100	4.2	300.0	20	28	28	12	25	15	21	13	22	22	25
2037	-10/10	9.0	40.0	-0.8	-0.8	-0.8	-0.8	-0.8	0.5	-1.0	-1.0	-1.0	-1.0	-1.0
2021	0/100	4.2	50.0	70	95	85	95	90	95	95	98	90	90	82
2022	0/100	4.8	25.0	37.5	48	41	43	44	47.5	47.5	48	42.5	43	40
2073	0/100	3.0	150.0	47.5	47.5	46	43	41	38	38	37	34	33	32
2074	0/100	3.0	180.0	76	73	65	60	55	51	53	48	46	46	44
2075	0/100	3.0	180.0	73	74	71	67	66	63	58	55	52	47	49
2076	0/100	3.0	144.0	54	55	50	44	47	43	40	40	37	32	35
2077	0/100	3.0	144.0	20	25	20	17	22	25	15	18	15	8	12
2024	0/100	4.2	98.6	60	58	59	58	48	46	36	32	28	20	19
2025	0/100	4.2	300.0	47	47	46	43	33	40	31	27	23	14	12
2026	-10/10	9.0	40.0	-1.5	-1.5	-1.5	-2.5	-2.4	-2.6	-2.7	-2.8	-3.6	-3.6	-2.0
2102	0/100	4.2	100.0	38	36	32	24	25	24	23.5	24	28	30	37
2020	0/100	4.2	300.0	58	55	55	45	55	50	55	54	58	60	65
2036	-10/10	9.0	20.0	-6.0	-2.0	-3.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
2028	0/100	4.8	50.0	42	53	50	60	60	72	68	70	75	70	70
2080	-2/2	9.0	40.0	60.5	63	62	65	70	66	67	65	66	69	72
Location*				Pressure, In. W.C.**										
1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2				58.1	62.1	49.0	66.9	65.6	59.4	69.1	80.8	65.4	74.8	68.3
3				174.8	178.3	152.2	179.0	177.3	171.0	185.4	204.5	180.0	196.6	194.3
4				263.0	265.2	234.6	261.3	254.4	248.1	262.4	284.9	253.1	268.9	267.3
5				295.3	321.6	291.0	268.8	300.6	264.5	297.0	295.6	291.0	306.9	314.4
6				291.1	317.5	286.9	264.7	296.6	267.0	292.0	290.4	285.9	301.8	309.4
7				239.6	248.0	225.8	198.5	230.1	197.0	222.1	221.3	221.3	237.2	250.0
8				169.2	176.9	157.0	134.7	167.2	139.1	164.3	167.0	169.8	187.4	201.6
9				-165.5	-161.1	-157.6	-148.7	-108.6	-125.3	-88.7	-72.3	-54.9	-19.5	-15.2
10				-194.4	-197.5	-187.3	-173.6	-140.2	-161.9	-111.0	-98.8	-77.1	-31.8	-33.6
11				3.1	3.1	3.0	5.2	5.0	5.3	5.5	5.7	7.4	7.5	4.1
12				85.8	88.0	71.1	81.0	81.1	73.8	83.0	94.6	83.7	94.9	95.3
13				227.8	222.6	205.6	185.0	218.7	195.2	219.0	223.0	227.8	244.3	259.7
14				198.7	212.8	190.9	175.3	208.7	185.3	209.1	213.4	217.9	234.5	249.8
15				173.2	181.9	161.5	140.5	174.9	145.2	170.9	172.9	176.0	194.8	210.2

*Refer to Figure 1.
**Static pressure at Location 1 is 150 psig.
Pressures given are differential pressures from Location 1.

Table 41-19. PRESSURE BALANCE DATA, RUN 41B

RUN 42

JANUARY 29 TO FEBRUARY 13, 1977

CO_2 ACCEPTOR PROCESS GASIFICATION

PILOT PLANT

RAPID CITY, SOUTH DAKOTA

1 SUMMARY

Run 42 was the first run to demonstrate the commercial flow sheet feature of using air as the acceptor lift gas to the regenerator. To eliminate the need for recycle gas for regenerator fluidization, the reactor inside diameter was decreased from 33 to 24 inches. Velva lignite was used for both the feedstock and the auxiliary fuel. The acceptor was Minnekahta limestone.

This run was very successful. Two steady-state balance periods, lasting 23 and 25 hours respectively, were achieved during the run. The use of air caused no detrimental effects in the lift line, nor was there any evidence of regenerator hot spots. Inspection of the regenerator after the run was voluntarily terminated revealed a very clean interior.

2 TEST DATA

Run 42 data are presented graphically and/or tabularly at the end of this report. These figures and tables include:

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3 SIGNIFICANT EVENTS AND OBSERVATIONS

3.1 TABULAR HISTORY

3.1.1 Objectives

(1) Achieve an integrated plant operation with no air or recycle gas to the gasifier.

(2) Demonstrate operation of the regenerator with a 24-inch inside diameter.

(3) Operate the regenerator with air to the acceptor lift line and no recycle to the regenerator.

(4) Obtain a steady-state balance period with regenerator overhead CO controlled at 1 to 3 percent and terminate the run voluntarily.

3.1.2 Accomplishments

(1) Operated the plant in an integrated manner for 116 hours with no air or recycle to the gasifier.

(2) Demonstrated the operation of the regenerator with a 24-inch diameter for 174 hours at process conditions.

(3) Demonstrated the operation of the ceramic-lined acceptor lift line with 100 percent air for 175 hours.

(4) Demonstrated the operation of the regenerator with only air as the fluidizing gas for 28 hours.

(5) Obtained two steady-state balance periods lasting 23 and 25 hours respectively.

3.1.3 Termination Causes

The run was ended voluntarily after all objectives had been achieved.

3.1.4 Mechanical Problems

(1) Numerous process and instrument lines were frozen due to extremely cold weather.

(2) The low side pressure tap of the differential pressure recorder controller, dPRC-2028, on the char lift line frequently plugged. The plugs caused false differential pressure readings which

upset the control of fuel char transfer from the gasifier to the regenerator. Consequently, the char transfer control valve had to be controlled manually during part of the run, until an alternate pressure tap could be used as input to the controller.

(3) The flow to the gasifier boot was suddenly lost while one of the zinc oxide towers was being depressured prior to changing the bed. The interface was lost as the boot drained. The interface was reestablished and normal operation was resumed.

(4) The regenerator vent line plugged near the pressure control valve, dPCV-2030, causing severe pressure swings. The gasifier interface was lost when acceptor lift gas backflowed through the recarbonated acceptor standleg into the gasifier. The vent line was cleared, the regenerator bed was refluidized, and the plant was brought back to normal operation.

(5) The acceptor lift gas heater, B-205, was inspected after the run. Inspection revealed that four tubes in the lower section contained six circumferential cracks. The coil was replaced.

3.1.5 Process Problems

(1) Lost char transfer twice for no apparent reason.

(2) Several times during the run, the rate of acceptor circulation from the regenerator to the gasifier gradually decreased. Extra purge was added ahead of the calcined acceptor flow control valve to help maintain circulation. Overhead circulation was lost once when a calcined acceptor sample was taken. This altered pressure sufficiently to cause loss of char transfer and the plugging of the regenerator quench tower outlet. When the plant was shut down, the calcined acceptor standleg was inspected. Inspection revealed scale about three-fourths inch thick along the bottom of the line.

3.2 CHRONOLOGY OF OPERATIONS

Date	Time	Hours Run	Description
1/29	1500		System pressure test.
"	1610		Depressured system to repair leaks.
1/30	2100		System pressure test.
1/31	0600		Depressured system to repair additional leaks.
"	0930		Repressured system.
"	1130		Depressured system to repair a recarbonated acceptor sample station leak.
"	1600		Repressured system.
2/1	0315		Fired process heaters and initiated program for regenerator refractory cure (reduced

Date	Time	Hours Run	Description
2/1	0315		inside diameter). Used interim period to check instrumentation, lines, and equipment.
"	1140		Regenerator control thermocouple at 250°F, started hold period No. 1 at this temperature.
2/2	0100		Gradually increased regenerator control temperature to 600°F.
"	0800		Regenerator temperature at 600°F, began hold period No. 2.
"	2330		Ended hold period No. 2, gradually brought system to operating temperature.
2/3	0600		Checked pressure drops in process heaters and gas distributors.
"	1352		Reactor temperatures lined out, added dead-burned dolomite to gasifier.
"	1625		Started dead-burned dolomite to regenerator via F-206.
"	1935		Started dolomite circulation.
"	2000		Conducted dolomite circulation tests.
2/4	0700		Completed dolomite circulation tests, started lift line flow tests.
"	0820		Completed lift line flow tests, conducted boot flow tests.
"	1025		Finished boot flow tests, added steam to gasifier side.
"	2205		Started char feed to gasifier.
2/5	0125		Started air to gasifier side.
"	0415		Started steam to gasifier boot.
"	1340		Attempted to start fuel char transfer to regenerator.
"	1455		Char transfer established.
"	1730	0	Regenerator at 1800°F.
"	2038	3.13	Started Velva lignite to gasifier.
"	2210	4.67	Charged F-206 with active limestone.
2/6	0024		Started CO_2 flow (1,000 SCFH) to gasifier.
"	0445		Started gasifier stepwise flow changes.
"	1030	17.00	Admitted synthesis gas to the methanation unit.
"	2022	26.87	All air flow removed from gasifier.
2/7	0610	36.67	All recycle removed from gasifier boot flow.
"	0715		Temporary problem with fuel char transfer to regenerator. Pressure tap to the fuel char transfer control valve plugged, causing false indication.
"	1330		Calcined acceptor standleg seemed to have minor restriction. Stroked valve TCV-2030, in the line, and circulation appears normal.

Date	Time	Hours Run	Description
2/7	1630	47.00	Gasifier boot flow dropped suddenly, slumping gasifier bed. Put some recycle flow back to gasifier boot. Blew char-acceptor interface, withdrew some of gasifier solids to F-213 and reestablished interface. Overhead circulation, lignite feed and char transfer were stopped. Upset due to switching of flow through gasifier ZnO unit.
"	1820		Restarted overhead circulation and char transfer.
"	1850	49.33	Restarted lignite feed.
"	1925		Restarted char transfer.
2/8	0130	56.00	Remaining recycle gas flow removed from gasifier boot.
2/9	0145		Elliott test stand put in service.
"	0910		Elliott test stand taken out of service due to plugging of gas control valve.
"	1822	96.87	Upset in system pressure caused by plugging at the regenerator pressure control valve. The gasifier interface was lost. Lignite feed, acceptor circulation, and char transfer were stopped. Steam was removed from gasifier boot. Recovered interface and restarted circulation.
"	2200		Restarted lignite feed.
"	2210	100.67	Admitted some air to gasifier side and restarted steam to boot.
2/10	0010	102.67	Removed remaining air from gasifier side.
"	0455		Char transfer to regenerator reestablished.
"	0527		Restarted synthesis gas to methanation after upset.
"	0705	109.58	All recycle gas removed from gasifier boot flow.
"	0735		Temporary loss of overhead acceptor circulation regained by increasing purge at TCV-2030 valve.
"	0910		Temporary loss of overhead circulation, regained by admitting additional purge to S-9.
"	1615		Temporary loss of overhead circulation regained by stroking TCV-2030 valve and increased purge at the valve.
"	2400	126.50	Lost acceptor circulation for 20 minutes when an S-9 sample was pulled, resulting in high regenerator bed level which caused solids carryover into quench system.
2/11	0223		Lost char transfer for no apparent reason.

Date	Time	Hours Run	Description
2/11	0445		Regained char transfer.
"	2115		Lost char transfer for no apparent reason.
"	2145		Regained char transfer.
2/12	1100	161.50	Synthesis gas removed from methanation unit in preparation for planned shutdown.
2/13	0005	174.58	Initiated planned, orderly shutdown of plant.

4 RESULTS AND DISCUSSION

4.1 BACKGROUND

Prior to this run, the inside diameter of the regenerator was reduced from 33 to 24 inches. During the shutdown, the plant underwent its annual inspection.

4.2 ACCOMPLISHMENTS

4.2.1 Major Operational Achievements

HOURS OF OPERATION

Acceptor Circulation	Process Conditions	Velva Lignite Feed	Fresh Acceptor Makeup	No Air to Gasifier	No Recycle to Gasifier	100% Air in Lift Line	100% Air in Regenerator
220	174	172	170	146	116	175	28

In addition to the above accomplishments, Run 42 provided another success. In this run, two balance periods of 23 and 25 hours respectively were obtained during which the pilot plant was at steady-state conditions.

4.2.2 Plant Data

The pertinent plant data is presented in Tables 42-1 through 42-13. Operating conditions are shown in Tables 42-1 and 42-2. Feedstock composite analyses are presented in Table 42-3. Effluent and circulated process stream solids analyses are shown in Tables 42-4 through 42-10. Pressure balance data and calculated pressure balances are given in Table 42-11. Locations and elevations of the pressure points are shown in Figure 42-1. The raw pressure balance data was corrected as described in the Run 17 report and forced to converge as described in the Run 28 report. Preheat temperatures of the feed streams are given in Table 42-12 for the two balance periods. Table 42-13 presents the composition of the scale found in the calcined acceptor transfer line.

4.2.3 Intermediate Fines

As usually is the case with Velva lignite, there were no problems due to the accumulation of intermediate fines in the gasifier char bed. This is because Velva lignite contains relatively little interstitial sand or clays. Figure 42-2 shows that throughout the run the amount of intermediate fines in the gasifier char bed normally ranged between 6 and 10 percent.

4.3 PROBLEMS

4.3.1 Deposits

(1) Gasifier. A hard wall deposit of dead-burned dolomite was found in the boot above the distributor. The deposit, which extended 18 inches above the distributor, caused no problems. A larger deposit of acceptor was found in the gasifier transition section. Apparently, this deposit formed during the recovery period following the upset which was caused by the plugging of the regenerator back pressure control valve. A small, hard, chunk-like deposit of acceptor was also found on top of the boot distributor. This chunk probably fell from the transition deposit during the shutdown.

(2) Calcined Acceptor Transfer Line. After the run ended, the calcined acceptor transfer line was opened and inspected. The spool piece above the control valve was found to be full of chunks of scale that had fallen from the inside of the line. The problems with acceptor circulation through this line that were encountered throughout the latter part of the run were probably caused by only a few chunks of scale. Most of the scale later came loose due to thermal stress as the line cooled during the shutdown.

The scale was tan in color, layered, hard, and composed mainly of calcium oxide (see Table 42-13). Similar deposits were found after Runs 28B and 33B which also used Velva lignite and Minnekahta limestone. Based upon past laboratory experiments, recarbonation of acceptor fines in the calcined acceptor standleg is the most probable cause of the line scale. Presently, nitrogen is used in the line for balance gas and for differential pressure tap purges. The nitrogen flow may not be sufficient to adequately purge all the CO_2 which accompanies the acceptor from the regenerator into the line. Alternate methods of purging CO_2 from the entering acceptor are now being considered.

4.3.2 Heater Deterioration

All of the process heaters were inspected after the run. All were in good condition except B-205, the acceptor lift gas heater. Visual inspection of the tubes in this heater revealed that four tubes in the lower section contained six cracked sections. Two sections of the cracked areas were removed and sent to the Maintenance Engineering Department of Continental Oil Company in Ponca City, Oklahoma, for examination.

A preliminary examination of the Incoloy 800 tubes indicated that polythionic acid cracking is the most likely cause of the failure. The new coil should not continue to deteriorate as rapidly in the

future. Air containing no sulfur will be the primary process gas heated instead of regenerator recycle gas. In addition, special precautions will be taken during startups and shutdowns to avoid condensation in the heater tubes.

4.4 METHANATION

Purified synthesis gases were passed through the methanation reactors for a total of 61 hours during the run. On three occasions, the methanation reactors had to be totally shut down due to upsets which occurred in the main gasification section. The first shutdown occurred on February 7, 1977, when the gasifier char-acceptor interface was lost. The second shutdown occurred on February 9, 1977, when the regenerator back pressure control valve plugged, and the third shutdown occurred when the calcined acceptor transfer and regenerator fuel char transfer were lost on February 11, 1977. Due to the unsteady-state nature of operation, meaningful heat and material balance data was not obtained for the packed tube reactor.

5 FUTURE PLANS

The next run will use the same coal and acceptor feedstocks. The main goals will be to determine whether the regenerator can be operated at neutral and/or oxidizing conditions. Efforts will also be made to accurately characterize the sulfur species in the regenerator overhead at reducing, neutral, and oxidizing conditions.

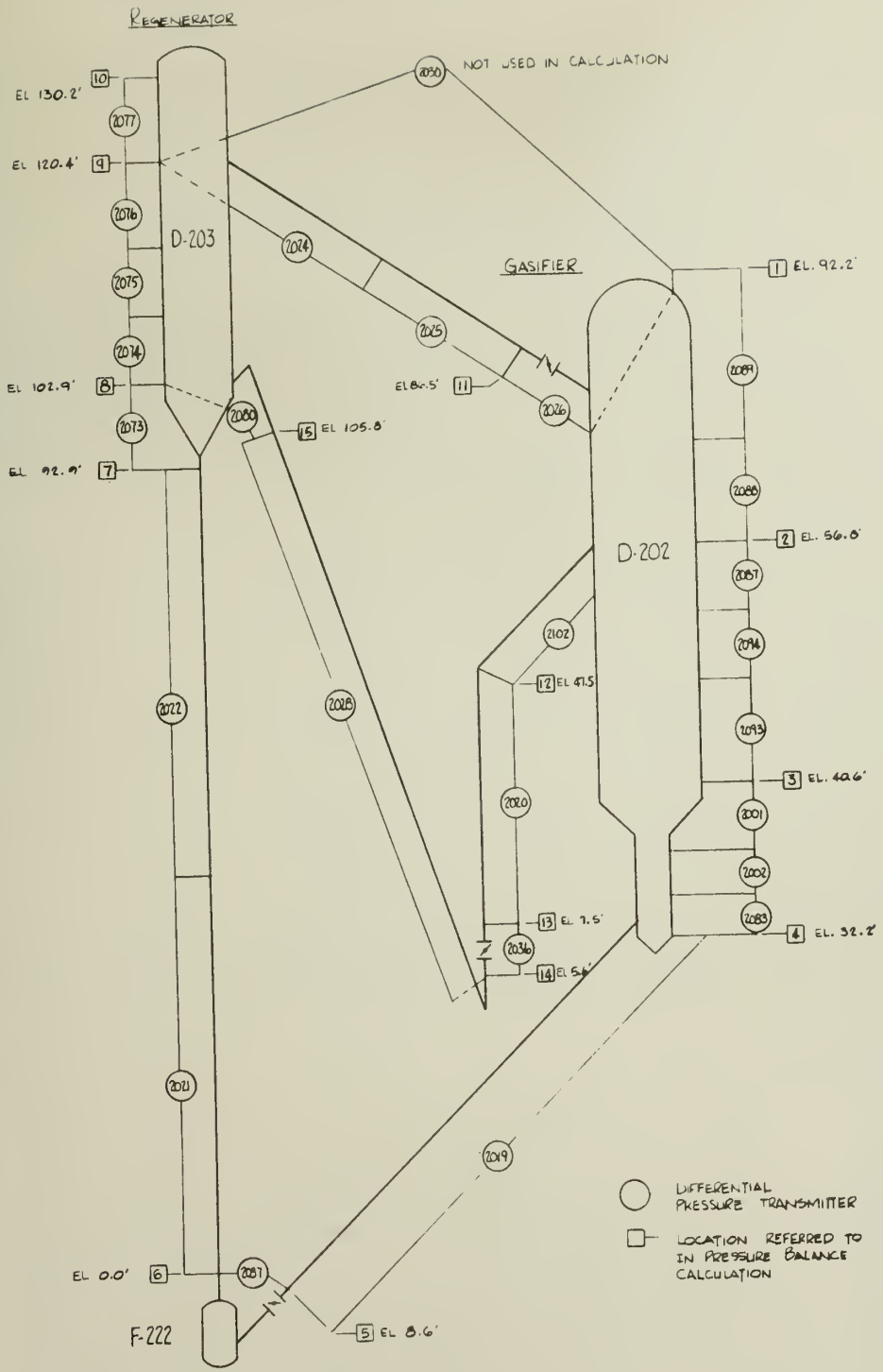

Figure 42-1. DIFFERENTIAL PRESSURE TRANSMITTER LOCATION FOR PRESSURE BALANCE CALCULATIONS

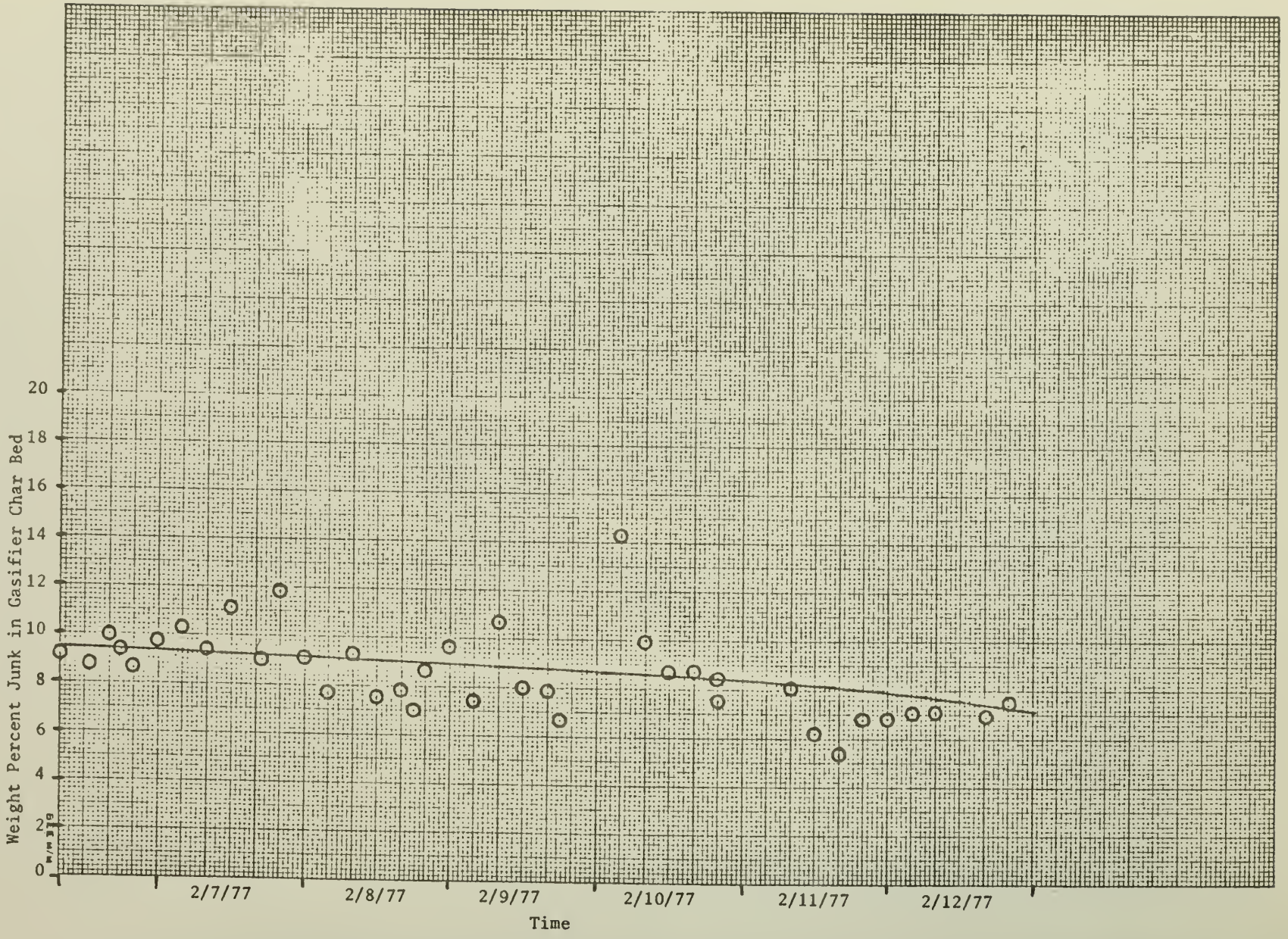

Figure 42-2. PERCENT JUNK IN GASIFIER CHAR BED FOR RUN 42

Date	2/5/77	← 2/6/77 →			← 2/7/77 →			← 2/8/77 →	
Time	2300	0700	1500	2300	0700	1500	2300	0700	1500
Solids	← Velva Lignite →								
Feedstock									
Feed Rate, lb/hr(1)	1,780	1,960	1,960	2,350	2,370	2,370	2,550	2,370	2,240
Cyclone Solids Dump, lb/hr	199	194	119	121	95	114	112	106	109
Quench Tower Solids, lb/hr	-	44	1	23	66	-	50	17	29
Gas Flows(2)									
Boot (Recycle), SCFH	19,500	12,600	14,400	8,350	0	0	8,230	0	0
Boot (Steam), SCFH	21,300	23,100	21,000	25,300	32,000	32,400	25,900	31,000	31,900
Boot (CO_2), SCFH	0	1,010	1,010	1,010	1,010	1,010	994	1,030	996
Side (Steam), SCFH	28,800	24,700	22,500	16,900	16,200	15,800	20,600	19,800	19,400
Side (Air), SCFH	19,900	12,700	11,600	0	0	0	0	0	0
Purge (Recycle), SCFH	← Instrument Out Of Service →								
Purge (Inert), SCFH	418	432	402	406	462	423	486	456	474
Purge (Nitrogen), SCFH	1,290	1,110	1,070	1,160	1,070	1,110	1,610	1,570	1,380
Total Flow In, SCFH	91,200	75,600	72,000	53,100	50,800	50,700	57,800	53,800	54,100
Vent Rate, SCFH	60,890	47,160	55,990	59,730	51,950	52,310	46,020	51,950	49,700
Bed Conditions									
Boot Velocity, ft/sec	2.08	1.86	1.84	1.73	1.63	1.65	1.76	1.57	1.61
Char Bed Inlet Velocity, ft/sec	.96	.81	.77	.56	.54	.54	.61	.57	.57
Boot Density, lb/ft^3(3)	93	90	102	86	83	78	78	75	74
Char Bed Density, lb/ft^3(3)	42	34	33	35	34	31	30	29	29
Boot Temperature, °F	1505	1539	1540	1521	1504	1498	1521	1490	1482
Char Bed Temperature, °F	1501	1527	1522	1513	1515	1501	1506	1495	1493
Overhead Gas Compositions, Mol%									
CO	17.40	6.80	16.80	16.60	14.90	13.80	14.80	14.40	14.10
CO_2	15.10	21.80	12.40	9.30	10.50	10.90	8.90	13.50	15.40
N_2	27.80	23.30	16.00	7.00	6.40	14.40	7.10	6.40	6.80
H_2	34.00	41.60	46.20	54.60	56.40	50.10	56.00	54.30	52.20
CH_4	5.70	6.50	8.50	12.40	11.70	10.70	13.10	11.30	11.40

(1) Determined by feeder RPM: Velva Lignite, 9.81 X ρ X RPM = 392.4 X RPM
(2) Determined by orifice flow meter measurements
(3) Determined by differential pressure measurements

Table 42-1. GASIFIER DATA FOR RUN 42 (Sheet 1 of 3)

Date	2/8/77		2/9/77				2/10/77		
Time	1900	2300	0300	0700	1145	1510	0700	1500	2300
Solids									
Feedstock	Velva Lignite								
Feed Rate, lb/hr[1]	2,240	2,350	2,350	2,350	2,390	2,390	2,370	2,550	2,350
Cyclone Solids Dump, lb/hr	109	141	141	148	125	125	171	168	158
Quench Tower Solids, lb/hr	-	28	-	19	-	24	36	47	48
Gas Flows[2]									
Boot (Recycle), SCFH	0	0	0	0	0	0	0	0	0
Boot (Steam), SCFH	30,600	30,800	30,800	30,800	30,900	31,700	30,700	29,400	29,200
Boot (CO_2), SCFH	1,020	1,010	1,010	986	1,010	977	1,010	967	1,010
Side (Steam), SCFH	19,800	19,400	19,400	19,400	19,000	17,800	23,200	18,900	17,000
Side (Air), SCFH	0	0	0	0	0	0	0	0	0
Purge (Recycle), SCFH	Instrument Out Of Service								
Purge (Inert), SCFH	516	434	450	459	466	429	458	410	358
Purge (Nitrogen), SCFH	2,440	1,820	1,710	1,710	2,090	1,770	1,660	2,040	1,160
Total Flow In, SCFH	54,400	53,500	53,400	53,400	53,500	52,700	57,000	51,700	48,700
Vent Rate, SCFH	52,670	52,540	53,850	54,140	55,690	52,470	49,390	50,040	53,300
Bed Conditions									
Boot Velocity, ft/sec	1.55	1.55	1.56	1.55	1.57	1.60	1.55	1.49	1.49
Char Bed Inlet Velocity, ft/sec	.57	.56	.56	.56	.56	.55	.60	.54	.51
Boot Density, lb/ft^3[3]	74	74	72	71	71	71	72	71	69
Char Bed Density, lb/ft^3[3]	29	29	30	29	29	29	27	33	32
Boot Temperature, °F	1485	1475	1484	1482	1488	1480	1472	1480	1491
Char Bed Temperature, °F	1494	1471	1488	1485	1492	1477	1493	1488	1502
Overhead Gas Compositions, Mol%									
CO	14.60	13.60	13.70	13.60	14.30	14.40	13.00	13.60	13.50
CO_2	10.40	11.20	11.50	11.50	7.90	10.40	9.00	9.00	9.00
N_2	7.50	8.10	7.70	7.50	7.70	6.90	8.30	7.30	8.30
H_2	55.70	54.40	54.80	55.10	58.00	55.90	56.50	56.50	56.30
CH_4	11.70	12.60	12.20	12.20	12.00	12.30	13.10	13.50	12.80

(1) Determined by feeder RPM: Velva Lignite, 9.81 X ρ X RPM = 392.4 X RPM
(2) Determined by orifice flow meter measurements
(3) Determined by differential pressure measurements

Table 42-1. GASIFIER DATA FOR RUN 42 (Sheet 2 of 3)

Date	2/11/77			2/12/77					
Time	0700	1500	2300	0300	0700	1100	1500	1900	2300
Solids	Velva Lignite								
Feedstock									
Feed Rate, lb/hr(1)	2,590	2,590	2,590	2,430	2,430	2,430	2,450	2,410	2,470
Cyclone Solids Dump, lb/hr	147	202	190	132	132	128	143	143	125
Quench Tower Solids, lb/hr	60	32	15		22	-	26	-	-
Gas Flows(2)									
Boot (Recycle), SCFH	0	0	0	0	0	0	0	0	0
Boot (Steam), SCFH	27,700	27,300	26,400	25,900	25,900	27,000	27,100	26,900	26,600
Boot (CO_2), SCFH	982	1,010	1,000	1,000	1,010	1,010	1,020	987	1,000
Side (Steam), SCFH	16,200	20,600	21,100	21,500	21,500	22,000	21,900	22,300	22,300
Side (Air), SCFH	0	0	0	0	0	0	0	0	0
Purge (Recycle), SCFH	2,070	2,310	2,370	2,520	705	887	2,300	2,730	2,230
Purge (Inert), SCFH	340	322	416	378	424	373	385	404	404
Purge (Nitrogen), SCFH	2,090	2,090	1,990	1,990	1,990	1,990	1,990	1,990	1,990
Total Flow In, SCFH	49,400	53,600	53,300	53,300	51,600	53,300	54,700	54,800	54,500
Vent Rate, SCFH	52,750	58,690	57,240	57,720	57,360	56,840	60,580	56,670	57,270
Bed Conditions									
Boot Velocity, ft/sec	1.41	1.40	1.35	1.33	1.33	1.38	1.39	1.37	1.36
Char Bed Inlet Velocity, ft/sec	.53	.57	.56	.57	.55	.56	.58	.58	.58
Boot Density, lb/ft^3(3)	68	68	68	68	69	68	66	68	68
Char Bed Density, lb/ft^3(3)	28	31	30	30	30	30	31	32	31
Boot Temperature, ^oF	1491	1498	1484	1500	1494	1490	1495	1489	1489
Char Bed Temperature, ^oF	1503	1504	1491	1512	1503	1504	1509	1503	1500
Overhead Gas Compositions, Mol%									
CO	13.20	13.70	13.40	14.50	13.90	14.70	14.80	14.70	
CO_2	9.30	10.90	9.20	10.00	11.10	9.90	8.10	9.40	
N_2	9.80	8.70	8.90	8.50	9.50	9.70	8.70	10.00	
H_2	54.60	54.60	55.80	55.40	54.00	53.80	56.30	54.00	
CH_4	13.00	12.10	12.70	11.60	11.50	11.80	12.00	11.80	

(1) Determined by feeder RPM: Velva Lignite $9.81 \times \rho \times RPM = 392.4 \times RPM$
(2) Determined by orifice flow meter measurements
(3) Determined by differential pressure measurements

Table 42-1. GASIFIER DATA FOR RUN 42 (Sheet 3 of 3)

Date	2/5/77	← 2/6/77 →			← 2/7/77 →			← 2/8/77 →	
Time	2300	0700	1500	2300	0700	1500	2300	0700	1500
Jacket Steam Make, lb/hr	300	380	400	400	415	400	415	410	340
Solids	← Minnekahta Limestone →								
Acceptor Feedstock	560	560	560	560	560	560	560	560	560
Acceptor Makeup, lb/hr(1)	600	500	307	347	369	369	239	239	319
Acceptor Withdrawal, lb/hr(3)	10,300	8,870	7,770	11,700	13,300	11,000	11,600	12,600	13,600
Acceptor Circulation, lb/hr(2)	-	-	143	152	181	237	193	251	169
Ash and Attrited Acceptor, lb/hr(3)	132	294	265	110	110	110	110	110	110
Auxiliary Fuel Char, lb/hr(1)									
Gas Flows(4)									
Acceptor Lift (Air), SCFH	57,200	58,300	57,700	56,500	56,000	57,200	57,100	54,200	56,500
Acceptor Lift (Recycle), SCFH	0	0	0	0	0	0	0	0	0
Char Lift, SCFH	9,920	10,100	10,400	10,200	10,200	10,100	10,500	10,500	10,400
Ring Flow (Recycle), SCFH	36,400	28,100	22,600	22,500	0	18,900	9,040	11,100	11,100
Ring Flow (Air), SCFH	0	15,500	17,500	14,600	26,500	28,300	25,700	24,700	22,400
Purge (Recycle), SCFH	1,850	1,770	3,920	1,810	1,610	1,470	1,950	1,460	1,470
Purge (Inert), SCFH	1,710	1,840	1,570	1,600	1,690	2,160	2,160	2,050	1,960
Purge (Nitrogen), SCFH	399	380	375	384	375	480	435	424	409
Total Flow In, SCFH	107,500	116,000	114,100	107,600	96,400	118,600	106,900	104,400	104,200
Vent Rate, SCFH	75,800	92,100	94,300	108,300	112,200	117,100	110,400	99,600	99,700
Bed Conditions									
Inlet Gas Velocity, ft/sec	3.625	3.937	3.782	3.766	3.295	4.011	3.566	3.521	3.502
Average Bed Density, lb/ft^3(5)	88	86	84	83	80	83	74	70	74
Average Bed Temperature, ^oF	1825	1834	1821	1842	1858	1826	1814	1828	1817
Overhead Gas Compositions, Mol%									
CO	4.04	3.06	2.15	5.09	0.92	5.09	10.02	2.15	3.06
CO_2	15.96	22.90	24.60	24.17	25.89	23.74	19.99	25.89	25.46
N_2	80.00	74.04	73.25	70.74	73.20	71.16	70.00	71.96	71.48

(1) Determined by feeder RPM: Dead-burned Dolomite, 360*RPM; Limestone, 280*RPM; Auxiliary Fuel, 368*RPM
(2) Determined by lift line pressure drop measurements
(3) Determined by weigh scale measurements
(4) Determined by orifice flow meter measurements
(5) Determined from pressure tap readings

Table 42-2. REGENERATOR DATA FOR RUN 42 (Sheet 1 of 3)

Date	2/8/77		2/9/77				2/10/77		
Time	1900	2300	0300	0700	1145	1510	0700	1500	2300
Jacket Steam Make, lb/hr	240	380	410	410	370	300	340	280	200
Solids	Minnekahta Limestone								
Acceptor Feedstock	560	560	560	560	560	560	560	560	560
Acceptor Makeup, lb/hr[1]	323	323	269	269	269	154	256	256	350
Acceptor Withdrawal, lb/hr[3]	14,700	13,700	13,600	13,600	14,200	12,100	9,700	12,100	13,100
Acceptor Circulation, lb/hr[2]	159	159	182	182	145	159	186	146	227
Ash and Attrited Acceptor, lb/hr[3]	110	110	110	110	110	110	92	184	110
Auxiliary Fuel Char, lb/hr[1]									
Gas Flows[4]									
Acceptor Lift (Air), SCFH	55,300	56,700	56,500	56,500	57,400	57,400	57,000	55,500	54,100
Acceptor Lift (Recycle), SCFH	0	0	0	0	0	0	0	0	0
Char Lift, SCFH	10,400	10,400	10,400	10,400	10,300	10,300	10,300	10,300	10,400
Ring Flow (Recycle), SCFH	11,100	11,200	11,100	11,100	11,000	11,000	11,200	11,100	0
Ring Flow (Air), SCFH	24,700	21,900	21,800	21,100	20,200	20,300	19,600	23,800	24,400
Purge (Recycle), SCFH	2,700	2,790	2,050	1,950	2,350	2,000	2,340	2,250	2,340
Purge (Inert), SCFH	2,020	2,020	2,000	2,000	1,890	1,890	1,660	1,640	1,330
Purge (Nitrogen), SCFH	528	458	446	446	488	452	441	482	384
Total Flow In, SCFH	106,200	105,500	104,300	103,500	103,600	103,300	102,500	105,100	93,000
Vent Rate, SCFH	107,900	104,100	94,900	92,100	100,900	96,000	105,800	90,600	102,400
Bed Conditions									
Inlet Gas Velocity, ft/sec	3.576	3.506	3.534	3.493	3.484	3.537	3.492	3.519	3.134
Average Bed Density, lb/ft^3[5]	76	78	79	82	77	81	70	73	62
Average Bed Temperature, ^oF	1838	1823	1848	1840	1836	1871	1863	1820	1841
Overhead Gas Compositions, Mol%									
CO	3.25	5.09	4.04	4.04	3.74	3.54	3.54	4.56	4.56
CO_2	25.03	24.60	25.46	25.46	25.46	25.46	25.89	25.46	27.19
N_2	71.72	70.31	70.50	70.50	70.80	71.00	70.57	69.99	68.25

(1) Determined by feeder RPM: Dead-burned Dolomite, 360*RPM; Limestone, 280*RPM; Auxiliary Fuel, 368*RPM
(2) Determined by lift line pressure drop measurements
(3) Determined by weigh scale measurements
(4) Determined by orifice flow meter measurements
(5) Determined from pressure tap readings

Table 42-2. REGENERATOR DATA FOR RUN 42 (Sheet 2 of 3)

Date	2/11/77			2/12/77					
Time	0700	1500	2300	0300	0700	1100	1500	1900	2300
Jacket Steam Make, lb/hr	350	320	0	100	100	150	250	0	200
Solids									
Acceptor Feedstock	Minnekahta Limestone								
Acceptor Makeup, lb/hr[1]	560	560	560	560	560	560	560	560	560
Acceptor Withdrawal, lb/hr[3]	186	171	171	280	280	275	275	359	359
Acceptor Circulation, lb/hr[2]	11,600	12,100	12,100	12,100	12,100	11,600	11,600	12,100	11,600
Ash and Attrited Acceptor, lb/hr[3]	188	174	183	179	149	149	159	186	186
Auxiliary Fuel Char, lb/hr[1]	188	103	114	114	114	114	92	110	118
Gas Flows[4]									
Acceptor Lift (Air), SCFH	57,800	57,500	57,000	57,000	56,600	56,000	57,200	57,100	57,000
Acceptor Lift (Recycle), SCFH	0	0	0	0	0	0	0	0	0
Char Lift, SCFH	10,270	10,100	10,200	10,200	10,200	10,200	10,200	10,200	
Ring Flow (Recycle), SCFH	0	11,100	11,100	11,000	11,100	11,100	0	5,500	5,570
Ring Flow (Air), SCFH	23,100	23,100	27,300	25,600	24,400	23,100	20,700	21,000	23,000
Purge (Recycle), SCFH	2,450	2,150	2,930	2,680	2,580	2,440	2,440	2,090	2,100
Purge (Inert), SCFH	1,010	1,010	1,440	1,350	1,350	1,550	1,660	2,160	2,160
Purge (Nitrogen), SCFH	488	488	476	476	476	476	476	476	476
Total Flow In, SCFH	95,100	104,900	110,300	108,300	106,700	104,900	92,700	98,500	90,300
Vent Rate, SCFH	108,800	100,800	114,600	114,300	109,400	99,800	103,600	103,800	102,900
Bed Conditions									
Inlet Gas Velocity, ft/sec	3.220	3.567	3.717	3.683	3.603	3.534	3.116	3.304	3.366
Average Bed Density, lb/ft^3[5]	68	70	67	73	68	72	70	74	73
Average Bed Temperature, ^oF	1845	1826	1837	1854	1838	1837	1847	1837	1829
Overhead Gas Compositions, Mol%									
CO	5.09	4.25	3.84	3.54	4.04	4.56	3.84	4.04	4.56
CO_2	24.17	25.46	26.32	26.76	26.76	26.32	26.32	27.19	25.89
N_2	70.74	70.30	69.84	69.70	69.20	69.12	69.84	68.77	69.55

(1) Determined by feeder RPM: Dead-burned Dolomite, 360*RPM; Limestone, 280*RPM; Auxiliary Fuel, 368*RPM
(2) Determined by lift line pressure drop measurements
(3) Determined by weigh scale measurements
(4) Determined by orifice flow meter measurements
(5) Determined from pressure tap readings

Table 42-2. REGENERATOR DATA FOR RUN 42 (Sheet 3 of 3)

Date: 2/1/77 to 2/12/77

Screen Size, Wt % Tyler Mesh	Acceptor Dead-Burned Dolomite[1]	Minnekahta Limestone	Screen Size, Wt % Tyler Mesh	Coal Velva Lignite
+6	↓	Tr	+8	↓
6 X 8	1.0	31.8	8 X 10	17.4
8 X 9	↓	23.8	10 X 14	↓
9 X 10	43.1	↓	14 X 20	53.8
10 X 12	26.8	41.6	20 X 28	↓
12 X 14	↓	2.2	28 X 35	20.6
14 X 16	26.8	0.3	35 X 48	↓
16 X 20	↓	Tr	48 X 65	8.2
20 X 24	1.5	0.2	65 X 100	
24 X 28	1.0	Tr	100 X 200	
-28		Tr	200 X 325	
			-325	
Ultimate Analysis, Wt %				
Moisture				0
C				66.02
H				4.58
S				0.79
N				0.35
Ash + SO_3				6.22
Elemental Analysis, Wt %				
SiO_2	1.38	2.84		18.74
SO_3	0.16	0.70		11.79
Na_2O	0.07	0.10		1.41
CaO	58.24	93.29		40.41
MgO	36.94	1.53		8.77
K_2O	0.10	0.06		0.31
Al_2O_3	0.88	0.84		11.05
Fe_2O_3	1.13	0.43		5.21
P_2O_5	0.01	0.03		0.16
TiO_2	0.04	0.12		0.37

[1] Run 37A screen Run 38A elemental analysis

Table 42-3. FEEDSTOCK COMPOSITES FOR RUN 42

Date	2/5/77	2/6/77		← 2/7/77 →			← 2/8/77 →			← 2/9/77 →				
Time	2330	0800	1600	0010	0800	1600	0000	0800	1600	← 0000 →				
Screen Size, Wt % Tyler Mesh														
+6	↓	0.1	↓	↓	0.1	↓	↓	0.3	↓	↓				
6 X 8	0.1	1.6	13.5	9.1	10.0	23.2	18.9	16.3	30.1	26.9				
8 X 9	↓	3.1	↓	↓	13.5	↓	↓	23.2	↓		↓			
9 X 10	10.7	11.8	29.8	23.0	23.5	38.9	40.0	29.7	47.5		41.7			
10 X 12	↓	42.1	↓	↓	29.7	↓	↓	19.4	↓			↓		
12 X 14	74.6	27.7	48.6	54.4	16.8	32.3	35.6	7.4	19.4			24.9		
14 X 16	↓	11.1	↓	↓	4.8	↓	↓	2.0	↓				↓	
16 X 20	12.6	2.2	7.5	10.3	0.9	4.5	3.4	0.9	2.1				3.0	
20 X 24	↓	0.2	↓	↓	0.2	↓	↓	0.4	↓					↓
24 X 28	0.2	0.2	0.1	1.5	0.1	0.3	0.8	Tr	1.5					1.1
-28	1.7	0.2	0.5	1.7	0.3	0.9	1.3	0.3	1.8					2.5
% Calcine Weight Change		-0.2	-0.4	-0.1	-0.2	-0.5	-0.4	-0.1	-0.2	-0.8	-0.5	-0.4	-0.5	-1.3
Elemental Analysis, Wt %														
Sulfide		0.10	0.03	0.04	0.01	0.02	0.02	0.01	0.04	0.07	0.07	0.07	0.07	0.07
SiO_2		2.67	4.09	4.26	4.37	4.60	4.79	5.82	5.28	4.64	5.39	5.67	8.13	16.40
SO_3		Tr	0.03	0.05	0.05	0.07	0.08	0.10	0.05	0.09	0.11	0.08	0.12	0.11
Na_2O										0.19	0.15	0.20	0.36	0.49
CaO										87.43	82.75	81.00	82.22	74.60
MgO										2.99	7.00	7.04	4.21	3.85
K_2O										0.02	0.02	0.03	0.07	0.18
Al_2O_3										2.60	2.83	4.14	3.12	2.23
Fe_2O_3										1.53	1.44	1.48	1.49	1.53
P_2O_5										0.07	0.07	0.08	0.09	0.08
TiO_2										0.16	0.11	0.13	0.20	0.20

Insufficient Sample

Table 42-4. CIRCULATED, CALCINED ACCEPTOR FOR RUN 42 (Sheet 1 of 2)

Date	← 2/9/77 →								← 2/10/77 →			
Time	0800			1200				1600	0030	0800	1600	2000[1]
Screen Size, Wt %												
Tyler Mesh												
+6	1.0	↓						↓	↓	5.3	↓	↓
6 X 8	35.8	36.9						44.2	36.4	36.5	37.4	28.5
8 X 9			↓					↓	↓	↓	↓	↓
9 X 10	37.3		39.5					39.6	32.3	31.5	32.5	32.8
10 X 12	12.7			↓				↓	↓	11.6	↓	↓
12 X 14	6.7			19.7				12.2	16.1	8.5	19.6	20.2
14 X 16	2.7				↓			↓	↓	3.4	↓	↓
16 X 20	1.8				2.8			2.4	5.3	1.8	7.3	9.6
20 X 24	1.0					↓		↓	↓	0.8	↓	↓
24 X 28	0.2					0.3		0.6	2.1	0.3	1.9	2.6
-28	0.9						0.7	1.0	1.9	0.3	1.2	6.2
% Calcine Weight Change	-0.9	-0.8	-0.4	-0.4	-0.5	-0.4	-2.0	-0.2		-1.6	-2.3	
Elemental Analysis, Wt %												
Sulfide	0.04							0.05		0.05	0.05	
SiO_2	5.61	4.50	4.70	5.07	7.32	8.34	13.37	5.40		5.08	5.39	
SO_3	0.08	0.15	0.12	0.10	0.12	0.18	0.17	0.07		0.05	0.20	
Na_2O		0.18	0.15	0.21	0.23	0.40	0.88					
CaO		86.35	84.31	85.09	82.12	81.90	77.78					
MgO		4.22	5.80	4.52	4.04	3.79	3.33					
K_2O		0.02	0.02	0.02	0.06	0.11	0.20					
Al_2O_3		2.56	2.87	2.28	2.80	3.03	2.33					
Fe_2O_3		1.29	1.36	1.29	1.40	1.33	1.20					
P_2O_5		0.07	0.07	0.08	0.06	0.08	0.06					
TiO_2		0.23	0.21	0.43	0.47	0.49	0.26					

[1] Last sample for this run due to plugged sample station

Table 42-4. CIRCULATED, CALCINED ACCEPTOR FOR RUN 42 (Sheet 2 of 2)

Date	← 2/6/77 →			← 2/7/77 →			← 2/8/77 →				← 2/9/77 →					
Time	0030	0800	1600	0000	0745	1730	0000	0800	1600	2000	← 0000 →					
Screen Size, Wt % Tyler Mesh																
+6	↓	↓	↓	↓	0.1	↓	↓	0.1	↓	↓	↓					
6 X 8	0.9	1.2	12.2	5.1	10.0	17.7	15.1	10.1	25.0	33.3	24.6					
8 X 9	↓	2.6	↓	↓	13.5	↓	↓	19.4	↓	↓		↓				
9 X 10	3.0	9.8	48.4	13.3	23.5	42.4	34.3	24.7	46.2	46.6		37.6				
10 X 12	↓	34.2	↓	↓	29.7	↓	↓	19.7	↓	↓			↓			
12 X 14	44.5	26.6	8.1	61.8	16.8	33.9	36.4	9.2	20.3	17.1			27.6			
14 X 16	↓	16.0	↓	↓	4.8	↓	↓	4.3	↓	↓				↓		
16 X 20	48.0	5.4	25.4	13.1	0.9	4.4	6.4	3.9	5.2	2.4				5.5		
20 X 24	↓	1.3	↓	↓	0.2	↓	↓	3.2	↓	↓					↓	
24 X 28	1.1	0.9	2.6	1.8	0.1	0.9	2.9	2.7	1.5	0.1					1.6	
-28	2.5	2.1	3.4	4.8	0.3	0.7	4.9	2.7	1.8	0.5						3.1
Particle Density, lb/ft^3		165	160	164			149	143	130	132	143	143	143	143	143	143
% Calcine Weight Change			-5.7	-5.5	-0.2	-8.1	-0.7	7.6	-6.2		-6.9	-6.4	-7.0	-8.1		-10.3
Activity		0.11	0.20	0.10			0.10	0.10	0.10	0.10	0.10	0.01	0.01	0.10	0.10	0.10
Elemental Analysis, Wt %																
Sulfide					0.01											
SiO_2			4.18	4.83	4.37	4.81	4.60	5.44	4.29		4.73	4.58	5.59	7.40		10.24
SO_3			0.09	0.09	0.19	0.08	0.12	0.08	0.07		0.13	0.11	0.13	0.10		0.12
Na_2O			0.07	0.11	0.11	0.09	0.12	0.15	0.18		0.15	0.19	0.15	0.19		0.71
CaO			67.70	69.73	75.33	80.35	81.84	82.30	82.92		88.00	83.91	83.73	82.9		79.68
MgO			24.84	21.66	15.69	9.33	8.23	8.41	7.91		3.11	6.46	5.91	3.98		4.52
K_2O			0.02	0.02	0.03	0.02	0.03	0.03	0.01		0.02	0.02	0.02	0.04		0.0
Al_2O_3			1.84	2.11	2.06	2.45	2.48	1.92	2.71		2.45	2.80	2.75	7.94		2.14
Fe_2O_3			1.21	1.19	1.38	1.28	1.41	1.36	1.23		1.20	1.48	1.38	1.53		1.61
P_2O_5			0.03	0.03	0.05	0.04	0.05	0.04	0.06		0.06	0.07	0.06	0.09		0.09
TiO_2			0.10	0.04	0.10	0.06	0.10	0.11	0.11		0.11	0.13	0.11	0.27		0.20

Insufficient Sample

Table 42-5. CIRCULATED, RECARBONATED ACCEPTOR FOR RUN 42 (Sheet 1 of 3)

Date	← 2/9/77 →									← 2/10/77 →				2/11/77	
Time	0400	0850	← 1200 →						1600	0400	0800	1600	2000	0800	1600
Screen Size, Wt %															
Tyler Mesh															
+6	↓	1.1	↓						↓	↓	2.3	↓	↓	3.4	↓
6 X 8	30.5	22.6	32.0						18.3	33.5	28.2	22.0	34.2	34.5	12.0
8 X 9	↓	26.0		↓					↓	↓	↓	↓	↓	↓	↓
9 X 10	34.8	18.4		35.7					30.8	31.6	35.0	36.2	34.4	33.5	28.6
10 X 12	↓	11.7			↓				↓	↓	11.2	↓	↓	11.1	↓
12 X 14	26.8	6.8			20.8				16.1	23.9	8.2	25.8	16.8	7.6	26.4
14 X 16	↓	3.9				↓			↓	↓	4.3	↓	↓	3.7	↓
16 X 20	5.1	3.8				5.0			13.0	6.3	3.7	7.5	7.2	2.8	15.8
20 X 24	↓	2.6					↓		↓	↓	2.5	↓	↓	2.0	↓
24 X 28	1.8	1.6					4.6		11.7	0.8	1.4	3.7	2.0	0.8	13.0
-28	0.9	1.7						1.9	10.1	3.8	3.1	4.9	5.3	0.7	4.2
Particle Density, lb/ft^3	139	133	132	132	132	132	132	132	141	138	136	142		128	133
% Calcine Weight Change		-7.8	-5.6	-7.4	-7.3	-8.6	-10.5	-13.0	-8.0		-7.4	-8.0		-8.5	-6.5
Activity	.10	.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.10	0.12	0.10
Elemental Analysis, Wt %															
Sulfide															
SiO_2		5.12	4.27	4.79	4.77	6.09	8.16	11.12	5.03		5.43	4.71		4.77	4.93
SO_3		0.07	0.11	0.12	0.12	0.15	0.20	0.22	0.07		0.06	0.02		0.20	0.10
Na_2O		0.17	0.15	0.14	0.16	0.19	0.22	0.32	0.17		0.15	0.14		0.16	0.13
CaO		84.10	85.47	84.40	83.72	82.70	81.45	78.22	85.41		84.71	85.95		87.36	87.37
MgO		5.02	4.76	4.21	4.27	3.62	3.57	3.50	4.94		3.73	3.91		3.05	3.19
K_2O		0.03	0.01	0.02	0.02	0.05	0.08	0.11	0.03		0.02	0.02		0.03	0.02
Al_2O_3		3.10	2.95	4.17	3.62	3.70	3.84	3.04	2.83		2.77	2.00		2.72	1.97
Fe_2O_3		1.37	1.45	1.12	1.37	1.56	1.55	1.32	1.32		1.24	1.35		1.23	1.27
P_2O_5		0.07	0.07	0.06	0.06	0.09	0.08	0.08	0.06		0.07	0.06		0.07	0.06
TiO_2		0.15	0.15	0.22	0.22	0.23	0.22	0.23	0.22		0.23	0.07		0.14	0.07

Table 42-5. CIRCULATED, RECARBONATED ACCEPTOR FOR RUN 42 (Sheet 2 of 3)

Date	2/11/77						2/12/77								
Time	2345						0430	0800	1200	1630	2045				
Screen Size, Wt % Tyler Mesh															
+6	↓						↓	4.3	↓	↓	↓				
6 X 8	34.4						30.6	29.6	27.3	26.0	23.8				
8 X 9		↓					↓	↓	↓	↓		↓			
9 X 10		35.2					30.0	34.8	33.6	38.1		37.8			
10 X 12			↓				↓	11.6	↓	↓			↓		
12 X 14			17.3				24.7	8.5	24.7	21.2			20.7		
14 X 16				↓			↓	4.1	↓	↓				↓	
16 X 20				7.1			8.0	3.1	9.2	9.0				9.2	
20 X 24					↓		↓	2.1	↓	↓					↓
24 X 28					3.4		3.4	0.8	2.3	3.9					1.9
-28						2.6	3.2	1.0	3.0	1.8					6.6
Particle Density, lb/ft^3	126	126	126	126	126	126		125	127						
% Calcine Weight Change	-6.4	-8.4	-8.3	-9.1	-11.0	-15.7		-7.2		-7.2	-7.1	-7.1	-7.1	-7.1	-7.1	-7.1
Activity	0.10	0.10	0.10	0.10	0.10	0.10		0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Elemental Analysis, Wt % Sulfide															
SiO_2	4.66	5.95	6.23	10.30	7.44	13.81		6.50		4.82	5.69	4.53	4.62	4.86	5.81	7.52
SO_3	0.17	0.22	0.22	0.20	0.20	0.30		0.17		0.30	0.16	0.12	0.12	0.15	0.25	0.17
Na_2O	0.18	0.21	0.17	0.21	0.20	0.26		0.16		0.13	0.13	0.14	0.16	0.14	0.15	0.18
CaO	87.38	84.23	82.88	79.65	83.91	75.71		84.58		86.59	85.60	86.93	86.59	85.97	84.05	81.83
MgO	2.90	3.35	3.43	3.04	3.04	2.74		2.89		3.05	3.16	3.10	3.19	3.31	3.71	3.72
K_2O	0.01	0.02	0.02	0.03	0.05	0.09		0.03		0.03	0.02	0.02	0.02	0.02	0.03	0.05
Al_2O_3	3.82	3.64	3.56	3.62	3.50	4.06		2.89		3.22	3.17	3.31	2.80	3.42	3.48	3.73
Fe_2O_3	1.15	1.37	1.30	1.45	1.56	1.36		1.36		1.35	1.35	1.12	1.12	1.25	1.72	1.84
P_2O_5	0.06	0.06	0.10	0.07	0.10	0.09		0.08		0.08	0.06	0.05	0.05	0.05	0.09	0.08
TiO_2	0.09	0.09	0.14	0.22	0.09	0.02		0.11		0.17	0.21	0.22	0.20	0.20	0.20	0.15

Table 42-5. CIRCULATED, RECARBONATED ACCEPTOR FOR RUN 42 (Sheet 3 of 3)

Date	← 2/6/77 →				← 2/7/77 →								2/8/77	
Time	0030	0745		1600		0000		0800		1730		1830	0000	
Sample	S-13B[1] Mix	S-13B Mix	Acc	S-13B Mix	Acc	S-13B Mix	Acc	S-13B Mix	Acc	S-13B Mix	Acc	S-13C[2] Mix	Acc	S-13B Mix	Acc
Screen Size, Wt %															
Tyler Mesh															
+8	0	0.9	↓	1.1	↓	2.3	↓	2.5	↓	3.4	↓	1.1	↓	1.3	↓
8 X 9	↓	↓	8.0	↓	17.9	↓	14.7	↓	22.1	↓	26.9	↓	23.8	↓	31.0
9 X 10	0.6	3.4	↓	4.8	↓	4.2	↓	9.7	↓	11.1	↓	2.3	↓	4.5	↓
10 X 12	↓	↓	41.8	↓	35.9	↓	40.2	↓	39.4	↓	38.7	↓	23.8	↓	29.6
12 X 14	25.8	29.4	20.9	21.2	12.8	25.2	14.1	21.9	11.5	20.3	8.6	14.2	4.8	12.5	5.6
14 X 20	15.3	14.0	13.5	10.7	12.8	9.3	11.4	8.3	8.7	7.5	6.5	6.7	9.5	5.9	8.4
20 X 28	5.8	4.9	6.0	5.9	5.1	3.5	4.3	6.7	4.8	6.5	4.3	4.9	9.5	5.6	5.6
28 X 35	16.7	14.0	↓	17.0	↓	16.3	↓	13.6	↓	16.6	↓	20.4	↓	17.2	↓
35 X 48	15.4	14.4	↓	17.2	↓	15.0	↓	15.4	↓	15.5	↓	19.3	↓	18.4	↓
48 X 65	9.6	9.5	9.7	11.1	15.4	10.4	15.2	10.4	13.5	9.6	12.9	13.5	28.6	13.5	16.9
65 X 80	↓	↓	Tr	↓		↓		↓		↓	0.1	↓		↓	2.8
80 X 100	6.5	6.2	↓	7.8		8.0		7.6		6.5	↓	11.2		11.5	↓
100 X 200	2.9	2.4	↓	2.5		4.2		3.2		2.3	↓	4.7		5.9	↓
200 X 325	0.5	0.3	↓	0		0.8		0.5		0.4	↓	0.9		1.5	↓
-325	0.8	0.6	Tr	0.6		0.8		0.3		0.2	0.1	0.9		2.1	Tr
% Acceptor		58.0		48.5		49.7		51.6		51.8		23.4		35.8	
Ash + SO_3 in Char, Wt %		13.30		15.78		14.73		14.11		12.59		14.47		11.59	
Elemental Analysis, Wt %															
SiO_2		22.76		17.44		17.93		15.71		15.05		14.74		15.18	
SO_3		3.71		4.74		3.52		4.36		2.45		0.89		1.76	

[1] S-13B sample from middle of char bed
[2] S-13C sample from bottom of char bed in the transition section

Table 42-6. GASIFIER CHAR BED MATERIAL FOR RUN 42 (Sheet 1 of 4)

Date	← 2/8/77 →						← 2/9/77 →							
Time	0800		1600		2000		0000		0400		0800		1200	
Sample	S-13B		S-13B		S-13B(1)		S-13B		S-13B		S-13B		S-13B	
	Mix	Acc	Mix	Acc	Mix	Acc	Mix	Acc	Mix	Acc	Mix	Acc	Mix	Acc
Screen Size, Wt % Tyler Mesh														
+8	2.8	↓	4.3	↓	3.8	↓	5.7	↓	5.8	↓	5.6	↓	6.8	↓
8 X 9	↓	32.5	↓	42.9	↓	41.2	↓	40.2	↓	50.6	↓	44.2	↓	44.9
9 X 10	5.6	↓	7.2	↓	10.8	↓	11.3	↓	11.0	↓	9.7	↓	13.4	↓
10 X 12	↓	31.3	↓	28.6	↓	25.5	↓	26.5	↓	20.5	↓	23.4	↓	24.6
12 X 14	9.1	6.3	19.5	2.4	16.6	3.9	16.6	4.5	13.0	4.8	14.7	5.2	12.2	4.3
14 X 20	3.9	8.8	6.3	7.1	7.8	9.8	6.3	9.1	6.0	8.4	6.6	9.1	6.8	10.1
20 X 28	3.5	6.3	3.7	4.8	4.7	3.9	4.4	5.3	4.7	4.8	4.8	5.2	6.0	4.3
28 X 35	10.5	↓	18.2	↓	19.6	↓	15.2	↓	14.9	↓	17.9	↓	15.7	↓
35 X 48	10.5	↓	16.1	↓	15.8	↓	14.0	↓	15.5	↓	16.4	↓	15.9	↓
48 X 65	7.6	13.8	10.8	14.3	10.0	13.7	10.0	13.6	11.5	10.8	11.3	11.7	10.7	11.6
65 X 80	↓	1.3	↓	↓	↓	2.0	↓	0.8	↓	↓	↓	1.3	↓	Tr
80 X 100	5.7	↓	8.2	↓	7.2	↓	8.6	↓	10.0	↓	8.7	↓	8.0	↓
100 X 200	2.2	↓	3.3	↓	2.7	↓	4.9	↓	5.2	↓	3.4	↓	3.3	↓
200 X 325	38.4	↓	0.4	↓	0.5	↓	0.9	↓	1.1	↓	0.3	↓	0.5	↓
-325	0.4	Tr	2.0		0.5	Tr	2.1	Tr	1.3		0.5	Tr	0.5	Tr
% Acceptor	43.4		41.0		44.2		51.4		40.9		58.6		50.6	
Ash + SO_3 in Char, Wt %	13.71		14.52		14.43		13.15		13.60		20.43		14.4	
Elemental Analysis, Wt % SiO_2 SO_3	16.48 1.53		14.87 1.05				16.86 1.44				15.98 1.29			

(1) S-13B sample from middle of char bed
(2) S-13C sample from bottom of char bed in the transition section

Table 42-6. GASIFIER CHAR BED MATERIAL FOR RUN 42 (Sheet 2 of 4)

Date	← 2/9/77 →				← 2/10/77 →						← 2/11/77 →			
Time	1600		1800		0800		1600		2000		0800		1600	
Sample	S-13B[1] Mix	S-13B[1] Acc	S-13C[2] Mix	S-13C[2] Acc	S-13B Mix	S-13B Acc	S-13B Mix	S-13B Acc	S-13C Mix	S-13C Acc	S-13B Mix	S-13B Acc	S-13B Mix	S-13B Acc
Screen Size, Wt %														
Tyler Mesh														
+8	7.7	↓	7.1	↓	8.2	↓	7.1	↓	12.1	↓	8.8	↓	9.4	↓
8 X 9	↓	47.0	↓	54.9	↓	33.3	↓	41.8	↓	50.0	↓	43.2	↓	41.3
9 X 10	11.4	↓	8.1	↓	9.4	↓	8.0	↓	13.3	↓	9.1	↓	10.8	↓
10 X 12	↓	19.3	↓	16.9	↓	25.9	↓	22.4	↓	19.6	↓	23.9	↓	19.8
12 X 14	10.5	4.8	13.5	4.2	16.3	6.2	9.8	6.1	12.0	4.9	14.7	5.7	13.7	19.0
14 X 20	7.0	8.4	6.2	7.0	8.6	11.1	37.6	10.2	7.1	7.8	6.7	9.1	7.4	7.9
20 X 28	7.6	6.0	4.6	4.2	5.2	7.4	2.2	6.1	6.2	4.9	3.4	5.7	5.2	4.0
28 X 35	15.6	↓	18.5	↓	16.5	↓	10.1	↓	12.4	↓	15.8	↓	15.3	↓
35 X 48	17.2	↓	16.5	↓	13.9	↓	9.3	↓	14.0	↓	15.0	↓	14.4	↓
48 X 65	11.5	13.3	11.5	12.7	9.8	16.0	6.3	13.3	10.1	11.8	11.0	12.5	10.3	7.9
65 X 80	↓	1.2	↓	Tr	↓		↓	Tr	↓	1.0	↓		↓	
80 X 100	8.5	↓	9.1	↓	7.4		5.8	↓	8.4	↓	9.0		9.2	
100 X 200	2.6	↓	3.8	↓	3.4		2.9	↓	3.7	↓	4.6		3.2	
200 X 325	0.3	↓	0.5	↓	0.6		0.3	↓	0.5	↓	1.0		0.5	
-325	0.1	Tr	0.5	Tr	0.6		0.2	Tr	0.3	Tr	1.0		0.5	
% Acceptor	38.1		39.6		42.7		44.8		42.5		44.3		44.6	
Ash + SO_3 in Char, Wt %	13.06		13.38		13.73		13.27		10.47		14.19		12.90	
Elemental Analysis, Wt %														
SiO_2	16.32		14.38		14.59		16.23				15.08		14.03	
SO_3	1.00		1.15		3.15		1.57				1.03		1.52	

[1] S-13B sample from middle of char bed
[2] S-13C sample from bottom of char bed in the transition section

Table 42-6. GASIFIER CHAR BED MATERIAL FOR RUN 42 (Sheet 3 of 4)

Date	← 2/11/77 →				← 2/12/77 →									
Time	1630		2345		0430		0800		1200		1630		2045	
Sample	S-13C[2]		S-13B[1]		S-13B		S-13B		S-13B		S-13B		S-13B	
	Mix	Acc	Mix	Acc	Mix	Acc	Mix	Acc	Mix	Acc	Mix	Acc	Mix	Acc
Screen Size, Wt % Tyler Mesh														
+8	10.6	↓	5.6	↓	5.0	↓	7.3	↓	8.0	↓	13.0	↓	7.6	↓
8 X 9	↓	50.6	↓	46.3	↓	38.7	↓	41.2	↓	43.1	↓	41.8	↓	42.9
9 X 10	12.7	↓	7.9	↓	6.0	↓	9.1	↓	13.4	↓	10.9	↓	12.7	↓
10 X 12	↓	22.5	↓	22.8	↓	25.8	↓	27.9	↓	23.2	↓	25.4	↓	23.8
12 X 14	11.9	4.5	10.1	5.7	10.4	6.5	19.1	5.9	16.8	6.6	15.7	6.6	12.6	6.0
14 X 20	6.6	9.0	6.0	8.9	5.6	11.3	8.9	8.8	8.2	11.0	6.6	10.7	6.8	10.7
20 X 28	5.2	4.5	3.5	5.7	1.9	6.5	4.1	5.9	4.3	5.5	3.8	5.7	4.6	6.0
28 X 35	13.6	↓	12.5	↓	13.0	↓	19.3	↓	12.8	↓	15.0	↓	14.6	↓
35 X 48	15.0	↓	11.5	↓	10.5	↓	13.8	↓	14.3	↓	13.2	↓	15.7	↓
48 X 65	10.9	9.0	7.9	10.6	7.6	11.3	8.9	10.3	9.8	9.9	9.3	9.8	11.0	10.7
65 X 80	↓		↓		↓		↓		↓	↓	↓	Tr	↓	Tr
80 X 100	8.9		6.2		6.3		6.4		7.6	0.6	7.5		9.0	
100 X 200	3.9		2.6		3.6		2.6		3.7		3.8		4.3	
200 X 325	0.5		25.9		28.7		0.3		0.4		0.6		0.7	
-325	0.2		0.4		1.5		0.3		0.4		0.5		0.4	
% Acceptor	41.9		41.8		39.8		43.7				43.6		44.6	
Ash + SO_3 in Char, Wt %	12.20		13.30		13.20		13.40				11.55		13.17	
Elemental Analysis, Wt %														
SiO_2	15.55		16.53				14.73				13.54		13.78	
SO_3	1.47		1.47				1.71				1.96		4.58	

(1) S-13B sample from middle of char bed
(2) S-13C sample from bottom of char bed in the transition section

Table 42-6. GASIFIER CHAR BED MATERIAL FOR RUN 42 (Sheet 4 of 4)

Date	2/5/77	2/6/77	← 2/7/77 →			← 2/8/77 →			← 2/9/77 →		
Time	1845	1855	0300	0900	1910	0400	1030	1845	0400	1000	1810
Screen Size, Wt %											
Tyler Mesh											
+35	0.9	1.3	0.8	1.3	0	3.8	0	0.1	0.5	0.8	0.7
35 X 48	0	0	0.2	0.2	Tr	1.9	Tr	Tr	0.1	Tr	0.2
48 X 65	0.2	2.2	1.2	1.1	1.8	3.0	1.1	1.2	1.1	1.1	1.3
65 X 100	5.5	14.1	7.7	7.7	11.7	8.2	9.0	8.1	8.5	7.1	8.7
100 X 200	41.5	38.9	37.1	38.7	43.3	32.9	38.2	38.8	42.6	36.6	41.2
200 X 325		25.1	40.4	33.1	17.9	18.7	18.6	22.6	20.5	21.3	20.4
-325	26.9	3.1	20.0	33.0	24.4	31.5	29.1	31.6	26.7	33.0	27.5
Ultimate Analysis, Wt %											
C	57.05	68.43		59.00	61.93	59.97		60.93	60.95	61.75	61.24
H	0.90	1.01		1.35	1.58	1.01		1.14	0.97	1.42	1.02
N	0.38	0.30		0.30	0.28	0.30		0.32	0.34	0.35	0.38
Total S	0.89	0.35		0.43	0.28	0.31		0.27	0.21	0.24	0.18
Ash + SO_3	30.01	22.90		24.04	20.81	25.23		22.62	22.58	21.62	21.94
Elemental Analysis, Wt %											
SiO_2	24.74	18.98		17.73	18.17	18.59		17.02	16.18	18.18	18.44
SO_3	7.31	3.06		4.37	3.22	2.99		2.67	2.19	2.63	1.74
Na_2O	2.04	2.32		1.98	1.70	1.34		1.91	2.00	1.77	2.35
CaO	41.51	51.13		51.77	50.71	52.25		52.77	53.00	51.99	52.32
MgO	6.73	9.07		8.55	9.00	8.67		9.13	9.05	8.99	8.17
K_2O	0.41	0.31		0.32	0.41	0.40		0.38	0.40	0.40	0.49
Al_2O_3	10.07	9.53		8.99	10.31	9.95		10.18	10.06	9.73	10.34
Fe_2O_3	6.76	5.16		5.62	5.37	4.98		5.27	5.39	5.02	4.98
P_2O_5	0.10	0.14		0.18	0.17	0.11		0.17	0.20	0.20	0.18
TiO_2	0.44	0.38		0.34	0.22	0.37		0.38	0.36	0.27	0.30

Table 42-7. GASIFIER CHAR TO EXTERNAL CYCLONE FOR RUN 42 (Sheet 1 of 2)

Date	← 2/10/77 →			← 2/11/77 →			← 2/12/77 →			
Time	0600	1115	2030	0500	1200	1845	0500	1200	1915	2345
Screen Size, Wt %										
Tyler Mesh										
+35	1.5	Tr	9	1.0	0	Tr	0.9	0.8	0.4	Tr
35 X 48	0.4	Tr	0.1	0.2	0.2	Tr	0.1	0.2	0.1	Tr
48 X 65	1.9	1.3	0.6	0.6	1.5	1.4	1.4	1.1	1.1	1.1
65 X 100	7.8	7.0	4.7	3.9	8.6	8.1	7.9	7.3	8.0	8.2
100 X 200	24.0	28.7	36.5	33.9	35.2	40.8	34.6	28.7	38.2	39.5
200 X 325	30.4	21.7	18.9	20.0	21.9	22.5	21.4	42.5	21.9	19.6
-325	34.0	41.4	39.2	40.3	32.6	27.2	33.6	19.4	30.2	31.7
Ultimate Analysis, Wt %										
C	55.41		61.05	60.51	60.26	60.86	59.20	60.39	61.57	62.99
H	0.85		0.79	1.15	0.83	0.89	0.85	1.25	1.18	1.11
N	0.24		0.36	0.36	0.37	0.35	0.31	0.28	0.34	0.02
Total S	0.26		0.28	0.26	0.20	0.24	0.32	0.34	0.24	0.20
Ash + SO_3	30.14		22.54	24.56	23.56	21.06	27.24	24.49	22.23	20.47
Elemental Analysis, Wt %										
SiO_2	12.37		16.69	17.25	17.86	17.05	13.84	16.11	16.28	16.67
SO_3	1.75		2.84	2.67	2.00	2.03	3.10	3.28	2.70	1.97
Na_2O	1.60		2.40	1.63	1.94	2.03	2.59	1.83	2.23	1.89
CaO	64.10		55.08	55.55	55.01	55.93	57.90	54.08	53.60	55.58
MgO	7.40		8.05	7.62	7.77	8.00	8.23	8.32	8.14	8.41
K_2O	0.29		0.41	0.38	0.44	0.47	0.41	0.47	0.53	0.41
Al_2O_3	7.48		8.74	8.53	8.73	8.56	7.69	9.27	9.80	9.55
Fe_2O_3	3.74		5.06	4.75	4.68	4.98	5.02	5.48	5.51	5.41
P_2O_5	0.16		0.20	0.18	0.14	0.17	0.20	0.19	0.14	0.14
TiO_2	0.32		0.30	0.21	0.33	0.28	0.36	0.28	0.34	0.31

Table 42-7. GASIFIER CHAR TO EXTERNAL CYCLONE FOR RUN 42 (Sheet 2 of 2)

Date	2/6/77	2/7/77	2/8/77	2/9/77	2/10/77	2/11/77	2/12/77
Screen Size, Wt %							
Tyler Mesh							
+35	48.1	7.4	40.6	25.8	11.0	2.8	0.5
35 X 48	9.7	8.8	0.7	4.4	8.2	1.4	0
48 X 65	4.2	5.1	1.0	4.1	7.2	1.4	0
65 X 100	8.7	8.8	2.5	6.2	9.8	1.4	0.7
100 X 200	17.5	25.1	10.2	25.9	41.6	38.4	7.2
200 X 325	9.2	40.9	39.2	30.2	21.3	51.6	77.9
-325	2.6	3.7	5.7	3.4	0.9	2.8	13.7
Ultimate Analysis, Wt %							
C	59.12	61.25	56.37	56.14	55.65	60.14	59.50
H	1.35	1.15	1.90	1.48	0.98	1.35	1.63
N	0.23	0.29	0.24	0.27	0.29	0.34	0.32
Total S	0.80	1.12	1.05	1.32	0.65	0.55	1.34
Ash + SO_3	29.50	25.14	28.14	29.18	24.36	22.98	24.82
Elemental Analysis, Wt %							
SiO_2	16.33	12.58	15.94	12.77	14.26	13.51	12.59
SO_3	7.00	10.88	9.51	11.46	6.28	5.56	13.15
Na_2O	2.13	1.68	1.38	1.23	2.10	2.22	1.51
CaO	49.12	52.07	51.39	57.37	58.91	58.84	52.46
MgO	4.95	4.24	5.03	3.64	4.54	6.05	4.07
K_2O	0.31	0.28	0.47	0.29	0.28	0.31	0.38
Al_2O_3	11.90	10.59	8.58	7.92	7.47	7.42	9.44
Fe_2O_3	7.26	6.42	5.64	4.27	4.42	4.57	5.45
P_2O_5	0.71	0.39	0.91	0.42	0.32	0.47	0.35
TiO_2	0.41	0.42	0.16	0.30	0.34	0.37	0.26

Table 42-8. GASIFIER QUENCH TOWER SOLIDS FOR RUN 42

Date	← 2/6/77 →			2/7/77		2/8/77		← 2/9/77 →					
Time	0320	1020	2100	0530	1350	0655	1630	← 0130 →					
Screen Size, Wt % Tyler Mesh													
+6	↓	0.1	↓	↓	Tr	0.1	↓	↓					
6 X 8	0	0.2	9.3	1.6	4.1	10.8	22.3	19.3					
8 X 9	↓	0.6	↓	↓	8.5	18.6	↓		↓				
9 X 10	0.4	7.0	28.5	11.8	26.4	27.5	50.3		34.5				
10 X 12	↓	36.7	↓	↓	31.7	21.9	↓			↓			
12 X 14	70.1	31.5	47.7	69.7	19.7	10.5	21.1			35.8			
14 X 16	↓	17.8	↓	↓	6.0	3.9	↓				↓		
16 X 20	26.3	5.0	12.3	13.4	1.7	2.6	4.3				5.2		
20 X 24	↓	0.7	↓	↓	0.7	1.7	↓					↓	
24 X 28	1.9	0.2	1.2	1.5	0.3	1.0	1.3					2.1	
-28	1.3	0.5	1.0	2.0	0.8	1.4	0.8						3.1
% Calcine Weight Change		-0.5	-0.6	-0.3	-0.6	-0.7	-0.4	-1.5	-0.8	-0.6	-0.6	-0.6	-0.9
Elemental Analysis, Wt % Sulfide													
SiO_2		3.00	4.20	4.08	4.10	4.52	3.90	4.58	5.06	6.00	7.46	8.53	13.13
SO_3		0.10	0.11	0.07	0.19	0.19	0.10	0.09	0.09	0.10	0.10	0.15	0.13
Na_2O		0.05	0.07	0.07	0.08	0.12	0.13	0.16	0.16	0.20	0.20	0.23	0.95
CaO		59.00	64.19	69.90	76.43	82.60	83.41	87.86	82.98	82.21	82.41	81.53	74.72
MgO		35.06	28.01	22.36	14.88	8.57	8.21	3.49	6.54	6.15	5.82	5.98	3.71
K_2O		0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.07	0.08	0.18	0.17
Al_2O_3		1.05	1.74	1.65	2.29	2.21	1.82	2.32	3.07	2.73	1.99	1.72	2.27
Fe_2O_3		1.50	1.35	1.36	1.47	1.30	1.40	1.11	1.53	1.33	1.48	1.59	1.40
P_2O_5		0.02	0.04	0.03	0.04	0.05	0.04	0.07	0.07	0.08	0.09	0.09	0.08
TiO_2		0.05	0.09	0.07	0.11	0.13	0.07	0.20	0.13	0.24	0.20	0.28	0.25

Table 42-9. ACCEPTOR WITHDRAWAL FOR RUN 42 (Sheet 1 of 3)

Date	← 2/9/77 →						2/10/77		2/11/77	
Time	← 1130 →						0550	1650	0115	1420
Screen Size, Wt %										
Tyler Mesh										
+6	↓						↓	↓	↓	↓
6 X 8	24.3						31.8	36.2	32.3	37.6
8 X 9		↓					↓	↓	↓	↓
9 X 10		34.2					36.5	33.5	29.6	31.3
10 X 12			↓				↓	↓	↓	↓
12 X 14			29.3				22.4	19.4	26.5	20.4
14 X 16				↓			↓	↓	↓	↓
16 X 20				8.7			5.2	6.4	7.7	6.9
20 X 24					↓		↓	↓	↓	↓
24 X 28					2.8		2.9	1.9	0.2	2.1
-28						0.8	1.2	2.5	3.8	1.8
% Calcine Weight Change	-1.1	-1.2	-1.1	-1.0	-1.1	-1.2	-1.1	-2.2		-1.1
Elemental Analysis, Wt %										
Sulfide										
SiO_2	4.30	4.64	4.85	6.60	7.00	11.51	4.68	5.13		5.79
SO_3	0.11	0.11	0.11	0.12	0.13	0.15	0.14	0.11		0.06
Na_2O	0.15	0.16	0.18	0.19	0.12	0.22	0.15	0.15		0.18
CaO	83.97	83.99	84.81	84.26	78.33	78.33	86.25	86.43		86.13
MgO	4.64	5.93	4.82	3.58	3.82	3.50	3.95	3.69		3.28
K_2O	0.02	0.02	0.02	0.06	0.06	0.15	0.03	0.02		0.02
Al_2O_3	2.87	3.27	3.04	3.19	2.63	3.04	2.76	2.59		2.71
Fe_2O_3	1.32	1.38	1.35	1.47	1.37	1.45	1.33	1.23		1.19
P_2O_5	0.07	0.07	0.07	0.09	0.09	0.09	0.06	0.06		0.06
TiO_2	0.23	0.23	0.23	0.23	0.23	0.29	0.23	0.09		0.11

Table 42-9. ACCEPTOR WITHDRAWAL FOR RUN 42 (Sheet 2 of 3)

Date	← 2/12/77 →											
Time	← 0000 →					0830	← 1730 →					
Screen Size, Wt %												
Tyler Mesh												
+6	37.1					4.3	26.4					
6 X 8		29.3				27.3		31.6				
8 X 9			25.0			36.5			30.1			
9 X 10				4.5		13.4				5.7		
10 X 12					0.9	8.4					1.7	
12 X 14						4.3						4.5
14 X 16						3.0						
16 X 20						1.5						
20 X 24						0.6						
24 X 28					3.3	0.6						
-28												
% Calcine Weight Change	-0.8	-1.0	-1.0	-1.1	-19.5	-0.5	-1.1	-1.5	-1.4	-1.6	-2.2	-2.6
Elemental Analysis, Wt %												
Sulfide												
SiO_2	4.56	4.81	5.07	6.96	11.74	4.52	4.32	4.58	4.66	5.52	8.52	9.86
SO_3	0.10	0.10	0.11	0.12	0.28	0.12	0.08	0.06	0.09	0.14	0.15	0.17
Na_2O	0.14	0.14	0.16	0.20	0.33	0.16	0.16	0.14	0.15	0.17	0.17	0.38
CaO	86.82	86.66	85.41	81.87	77.87	87.14	87.04	87.57	86.30	84.97	81.97	80.21
MgO	3.30	3.13	3.45	3.30	3.04	3.64	3.44	3.23	3.67	3.53	3.45	3.42
K_2O	0.02	0.02	0.03	0.02	0.13	0.02	0.02	0.02	0.02	0.03	0.05	0.12
Al_2O_3	3.03	2.90	3.34	3.69	4.19	1.92	3.25	2.80	3.31	3.54	3.67	3.87
Fe_2O_3	1.10	1.05	1.38	1.47	1.37	1.39	1.31	1.22	1.47	1.65	1.53	1.69
P_2O_5	0.07	0.07	0.07	0.08	0.07	0.06	0.08	0.06	0.08	0.08	0.09	0.08
TiO_2	0.22	0.17	0.17	0.20	0.20	0.20	0.15	0.17	0.12	0.19	0.15	0.12

Table 42-9. ACCEPTOR WITHDRAWAL FOR RUN 42 (Sheet 3 of 3)

Date	2/6/77	2/7/77	← 2/8/77 →			← 2/9/77 →			2/10/77		2/11/77		2/12/77	
Time	Composite	Composite	0110	1100	1715	0100	1110	1900	1250	Composite	1310	Composite	2000	Composite
Hopper	B	B	B	B	B	B	B	B	A	B	A	B	A	B
Screen Size, Wt %														
Tyler Mesh														
+35	6.0	9.4	14.3	25.6	34.0	12.8	66.8	41.8	24.1	10.0	74.5	10.5	14.0	13.4
35 X 48	8.9	4.9	7.0	6.2	5.8	5.3	0.7	4.9	1.8	8.0	2.3	6.1	8.7	6.0
48 X 65	10.6	5.2	6.8	6.0	5.8	6.2	0.6	5.4	1.5	8.3	1.7	6.4	9.3	6.9
65 X 100	14.0	6.6	8.7	8.2	8.1	9.2	0.8	7.6	2.1	11.1	2.3	8.8	12.2	10.3
100 X 200	20.3	12.3	17.1	17.2	16.4	19.7	1.8	14.2	4.0	20.3	3.9	17.6	20.5	21.3
200 X 325	15.6	14.8	13.0	16.0	18.6	13.4	1.4	9.3	32.6	6.9	7.1	20.8	16.5	22.8
-325	24.6	46.8	32.9	21.1	11.3	33.4	28.0	16.7	34.0	35.4	8.2	29.8	18.9	19.3
Ultimate Analysis, Wt %														
C	4.67	4.04	3.73			7.38				4.32		8.07		4.20
H	0.56	0.22	0.21			0.20				0.46		0.59	0.16	0.23
N	0.05	0.04	0.04			0.01				0.04		0.04	0.01	0.03
Sulfide	0.40	0.27	0.46			-				0.40		0.45	-	-
Total S	0.95	1.18	0.65			0.40				0.73		0.95	0.75	0.97
Ash + SO_3	94.57	93.96	93.32			92.06				92.25		90.14	91.95	90.82
Elemental Analysis, Wt %														
SiO_2	16.84	18.30	14.95			14.08				12.13		12.07	13.36	14.03
SO_3	2.48	2.98	1.48			1.06				1.81		2.62	3.12	2.66
Na_2O	2.14	1.24	1.02			1.47				1.92		1.17	1.19	1.56
CaO	60.23	61.80	68.22			69.59				71.26		69.73	63.55	66.19
MgO	6.25	5.29	4.61			4.92				4.31		4.73	5.35	5.06
K_2O	0.37	0.38	0.42			0.41				0.39		0.49	0.41	0.54
Al_2O_3	7.89	7.10	6.15			5.65				5.14		5.63	7.12	6.40
Fe_2O_3	3.48	2.41	2.47			2.37				2.27		2.28	3.38	2.68
P_2O_5	0.07	0.10	0.11			0.12				0.13		0.13	0.17	0.13
TiO_2	0.50	0.34	0.19			0.21				0.22		0.16	0.24	0.18

Table 42-10. ASH AND ATTRITED ACCEPTOR FOR RUN 42

Date				← 2/6/77 →			← 2/7/77 →			← 2/8/77 →		
Time				0300	1100	2225	0300	1110	2000	0300	1110	1930
dPR-*	Chart	Zero PSI	Range In. W.C.	Instrument Readings								
2030	-10/10	9.0	554.0	5.6	6.1	5.5	5.5	5.8	5.5	5.5	5.4	7.8
2089	0/100	4.2	25.0	15	30	36	51	40	13	40	45	20
2088	0/100	3.0	168.7	32	29	31	31	30	22	27	26	25
2087	0/100	3.0	43.7	70	63	66	64	64	52	56	53	55
2094	0/100	3.0	53.9	82	60.5	65	64	64	51	56	54	55
2093	0/100	3.0	115.4	37.5	33.5	35	34	34	27	29	29	29
2001	0/100	3.0	126.2	20	18	18.5	19	19	16	18	16	18
2002	0/100	3.0	57.1	39	39.5	35.5	36	36	35	36	36	35
2083	0/100	3.0	57.7	61	59.5	57	56	53	52	51	49	48.5
2019	0/100	4.2	300.0	45	45	40	33	32	25	30	28	24
2037	-10/10	9.0	100.0	-1.7	-1.9	-2.0	-2.0	-3.2	-3.3	-2.2	-1.8	-7.1
2021	0/100	4.2	50.0	80	84	96	96	93	78	88	85	97
2022	0/100	4.8	50.0	35	34	37	36	35	35	39	40	46
2073	0/100	3.0	150.0	48	47.5	46	45	43	40	40	40	40
2074	0/100	3.0	180.0	85	78	73	69	70	64	62	58	65
2075	0/100	3.0	180.0	78	72	69	69	66	66	62	65	64
2076	0/100	3.0	144.0	42	39	40	38	38	25	38	40	37
2077	0/100	3.0	144.0	23	17	19	18	16	15	18	19	21
2024	0/100	4.2	93.6	68	60	54	54	60	57	55	52	68
2025	0/100	4.2	300.0	35	43	39	40	42	42	41	40	59
2026	-10/+10	9.0	40.0	-0.7	-0.7	-1.2	-1.1	-1.2	-2.4	-2.6	-1.9	-5.6
2102	0/100	4.2	100.0	45	33	42	37	32	36	37	33	28
2020	0/100	4.2	300.0	75	70	68	58	61	63	51	47	31
2036	-10/+10	9.0	100.0	-3.5	-7.0	-5.5	-5.0	-2.0	-4.0	-2.0	-1.2	-1.0
2028**	0/100	4.8	50.0	63	55	68	65	68	59	61	58	22
2029	0/100	4.2	50.0	-	-	-	-	-	-	-	-	-
2080***	-2/2	9.0	40.0	93	89	89	94	95	98	95	92	99
Location*				Pressure, In. W.C.****								
1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2				57.1	56.0	60.2	65.5	58.8	41.1	55.0	56.4	47.0
3				180.6	153.2	165.9	166.4	164.1	127.0	144.7	143.6	137.4
4				267.5	231.1	243.1	242.5	241.7	200.7	218.4	213.6	210.5
5				379.3	335.1	334.8	311.7	310.8	249.1	280.2	269.4	255.1
6				370.4	325.9	324.8	301.9	294.4	231.9	269.1	260.3	218.6
7				315.7	265.6	259.1	235.4	230.8	178.6	206.8	199.0	149.8
8				245.4	190.7	189.1	165.5	166.8	120.0	146.0	138.2	90.2
9				-126.6	-145.5	-129.2	-135.5	-141.8	-144.0	-134.4	-134.2	-195.8
10				-162.5	-171.9	-158.1	-162.3	-166.6	-166.2	-161.6	-161.9	-227.1
11				1.3	1.4	2.4	2.2	2.4	5.0	5.2	3.9	11.3
12				90.6	80.7	92.7	93.5	80.8	66.5	82.4	79.8	65.0
13				281.7	270.8	268.5	242.4	232.1	192.2	205.9	192.4	128.6
14				198.5	234.7	241.1	217.0	222.4	173.0	197.0	186.4	123.7
15				263.0	205.6	204.5	182.5	185.0	139.8	163.8	154.8	110.1

*Refer to Figure 1.
**Sensing line moved on dPT-2028 on 2/9/77. Both dPT-2028 and dPT-2029 now required for pressure balance.
***Range changed on dPT-2080 from 40 to 60 inches water on 2/9/77.
****Static pressure at Location 1 is 150 psig.
Pressures given are differential pressures from Location 1.

Table 42-11. PRESSURE BALANCE DATA FOR RUN 42 (Sheet 1 of 2)

Date				2/10/77		2/11/77		← 2/12/77 →			
Time				0830	1420	1600	1915	0320	1300	1930	2330
dPR-*	Chart	Zero PSI	Range In. W.C.	Instrument Readings							
2030	-10/10	9.0	554.0	5.8	4.5	5.4	4.5	4.0	3.9	3.8	3.9
2089	0/100	4.2	25.0	7	31	64	67	74	74	60	63
2088	0/100	3.0	168.7	24.5	30	29	29	26	28	28.5	28
2087	0/100	3.0	43.7	58	65.5	58	60	57	58.5	60	59
2094	0/100	3.0	53.9	62	67	61	62	60	61	61	62
2093	0/100	3.0	115.4	30	33.5	30	31	29	30	30.5	31
2001	0/100	3.0	126.2	19	20	18	18	17	18	18	18
2002	0/100	3.0	57.1	57.1	32.5	32.5	32.5	32.5	42.5	33	33
2083	0/100	3.0	57.7	47.5	47	45	45	45	45	45	45
2019	0/100	4.2	300.0	33	33	21	26	35	35	31	33
2037	-10/10	9.0	100.0	-3.5	-2.4	-2.5	-2.0	-2.0	-2.0	-2.1	-2.1
2021	0/100	4.2	50.0	91	90	94	94	92	93	92	91
2022	0/100	4.8	50.0	41	39	40	40	40	37	38	40
2073	0/100	3.0	150.0	38	37.5	36	36	35	35.5	36	36
2074	0/100	3.0	180.0	60	62	57	58	59	59	59	58
2075	0/100	3.0	180.0	63	65	62	60	60	60	61	62
2076	0/100	3.0	144.0	35	35	33	32	34	32	35	34
2077	0/100	3.0	144.0	22	25	21	19	20	18	17	18
2024	0/100	4.2	93.6	55.5	65	67	63	45	43	44	45
2025	0/100	4.2	300.0	47.5	32	47	37.5	37.5	37.5	37	37.5
2026	-10/+10	9.0	40.0	-6.6	-7.2	-22.5	-17.4	-16.6	-15.6	-16.0	-16.6
2102	0/100	4.2	100.0	38.5	45	41.5	42.5	41	41.5	43	43
2020	0/100	4.2	300.0	43	63	50	43	55	50	51	52
2036	-10/+10	9.0	100.0	-1.6	-3.5	-2.0	-2.5	-2.4	-1.8	-2.0	-2.0
2028**	0/100	4.8	50.0	48	45	47	46	43	47	44	45
2029	0/100	4.2	50.0	40	35	45	46	40	45	44	45
2080***	-2/2	9.0	60.0	100	88	97	77	80	78	74	75

Location*	Pressure, In. W.C.****							
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	44.2	57.7	62.0	66.5	61.8	65.6	64.5	63.4
3	130.8	163.1	157.7	159.1	152.5	154.6	158.9	157.7
4	195.6	235.2	226.8	224.2	218.3	224.1	226.4	224.5
5	260.2	306.3	261.8	271.6	293.9	296.4	290.2	293.7
6	244.1	294.2	249.1	262.0	284.0	286.9	279.8	283.4
7	173.7	231.1	184.3	193.2	218.1	219.1	215.0	217.5
8	110.7	174.2	130.2	135.8	163.8	161.7	159.3	161.3
9	-152.4	-107.5	-143.5	-119.3	-100.4	-98.8	-100.6	-101.5
10	-184.0	-144.8	-176.2	-147.3	-130.3	-125.8	-125.5	-128.3
11	13.7	14.4	19.3	20.5	20.1	20.2	20.7	20.3
12	75.5	92.8	93.3	100.8	93.6	99.3	98.3	97.5
13	184.8	252.2	212.9	205.9	232.1	228.1	224.5	227.8
14	176.2	234.9	203.1	192.9	220.0	218.6	214.4	217.6
15	138.1	197.0	158.7	151.1	181.4	1774.	173.3	175.8

*Refer to Figure 1.
**Sensing line moved on dPT-2028 on 2/9/77. Both dPT-2028 and dPT-2029 now required for pressure balance.
***Range changed dPT-2080 from 40 to 60 inches water on 2/9/77.
****Static pressure at Location 1 is 150 psig.
Pressures given are differential pressures from Location 1.

Table 42-11. PRESSURE BALANCE DATA FOR RUN 42 (Sheet 2 of 2)

Date		2/8/77 - 2/9/77	2/11/77 - 2/12/77
Time		1900 - 1800 Hours	2300 - 2400 Hours
		Temperatures, °F	
Gasifier			
Lignite Feed	TE-2215/16	370	375
Boot Heater Outlet	TE-2058	1500	1500
Boot Inlet Gas	TE-2040	1385	1350
Side Flow Heater Outlet	TE-2057	1500	1500
Regenerator			
Acceptor Lift Gas Heater Outlet	TE-2050	815	800
Lift Gas at Engager Pot	TE-2013	800	785
Char Lift Gas Heater Outlet	TE-2054	800	800
Char Lift Station Gas	TE-2041	765	770
Char Disengager Pot	TE-2028	525	540
Ring Flow Heater Outlet	TE-2047	800	800
Ring Flow to Regenerator	TE-2026	735	735

Table 42-12. BALANCE PERIOD AVERAGE PREHEATS FOR RUN 42

Elemental Analysis, Wt %	
SiO_2	6.71
SO_3	0.50
Na_2O	0.21
CaO	79.67
MgO	3.39
K_2O	0.02
Al_2O_3	5.19
Fe_2O_3	2.66
P_2O_5	0.06
TiO_2	0.20
% Calcine Weight Change	-32.7

Table 42-13. SCALE FROM CALCINED ACCEPTOR TRANSFER LINE FOR RUN 42

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